INDUSTRIAL ARTS and VOCATIONAL EDUCATION

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No. 4

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CONTENTS

From Concepts to Techniques, *by Verne C. Fryklund*..... 111
Social Security and Industrial Education, *by John F. Friese*..... 114
Three Teacher Types, *by Homer J. Smith*..... 116
Guidance: Educational and Vocational, *by Edward F. Fitzpatrick*.... 118
The Challenge of Changed Conditions, *by Archie P. Nevins*..... 119
Editorials 122
Related Subjects Material for the Drafting Room, *by J. K. Olsen*..... 120
Glossary of Printers' Terms — I, *by R. Randolph Karch*..... 124
Building a Sea-Scout Base, *by Orville Hayford*..... 127

Supplement

Secretary and Bookshelves, *by J. I. Sowers*.....No. 337

Problems and Projects

Secretary and Book Shelves, *by J. I. Sowers*..... 129
Bluebird House, *by W. L. Dorrance*..... 129
Gauge for Shearing Band Iron, *by Jos. J. Lukowitz*..... 130
A Novel Wren House, *by W. W. White*..... 130
Air-Tight Showcase for the School Museum, *by John Y. Dunlop*..... 130
Waterproof Match Box, *by Carl Abrams*..... 131
Leather File or Screw-Driver Handle, *by George C. Abbe*..... 131
An A.C.–D.C. Radio Receiver, *by Gilbert Oberweiser*..... 132
Octagonal Bird Bath, *by Harry W. Kroll*..... 133
Candlesticks, *by H. M. Andersen*..... 134
Embossing Hammer, *by Henry J. Kaufman*..... 135
Homemade Rubber Stamp, *by Frank Bentley, Jr.*..... 135
Square Match-Box Holder, *by William J. Becker*..... 135
Archery Rack, *by George W. Bowen*..... 136
Alaskan Eskimo Snowshoes, *by W. Ben. Hunt*..... 137
A Safe Electric Lamp Tester, *by Leonard Wright*..... 138
Meat-Cutting Boards, *by Louis F. Barocci*..... 138
Pages from a Museum Sketchbook (Tin Candle Sconce), *by Burl N. Osburn*..... 138
The Mortise-and-Tenon Joint — VIII, *by John E. Doren*..... 139
Old Table Knife Makes Handy Grease-Cup Filler, *by Frank Bentley, Jr.* 140
Treat Dish, *by Joseph J. Lukowitz*..... 141
Italian Renaissance Floor Lamp, *by Reinhold Forkel*..... 142

Association News 142
Personal News..... 12A
School-Shop Equipment News..... 15A

IN THIS ISSUE

A perusal of the table of contents shows that this issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION is especially rich in teacher-reader interest. All of the material presented is as basic as it is up to date.

There is, for instance, the article "From Concepts to Techniques" by Verne C. Fryklund, in which the education of the individual is strongly emphasized. Then there is the article by John F. Friese "Social Security and Industrial Education," in which the author, in his usual thoughtful style outlines the exceptional opportunities which the present age presents to the shop teacher who is ambitious enough to embrace them. Another article that deserves to be mentioned is Homer J. Smith's interesting and thought-provoking "Current Comment" entitled "Three Teacher Types." Other articles which will interest shop teachers are Fitzpatrick's "Guidance: Educational and Vocational"; and Nevins' "The Challenge of Changed Conditions."

The instructors interested in related subjects will find Olsen's "Related Subjects Material for the Drafting Room" and Karch's "Glossary of Printers' Terms" full of suggestions, if not of actual use.

Real inspiration for helping students develop civic-mindedness and community pride is contained in Hayford's "Building a Sea-Scout Base," while Dunlop's article, "Air-Tight Showcase for the School Museum," presents a project which will help the students acquire helpful attitudes toward school and shop maintenance problems.

In the "Problems and Projects" section, there are items of interest for the woodworker, the metalworker, the electrician, the archery enthusiast, and the boy-scout or boy-camp executive. Of special interest, in this section, are the "Secretary and Book Shelves," by J. I. Sowers, the "Gauge for Shearing Band Iron," by Jos. J. Lukowitz, the "A.C.–D.C. Radio Receiver," by Gilbert Oberweiser, and the "Alaskan Eskimo Snowshoes," by W. Ben. Hunt.

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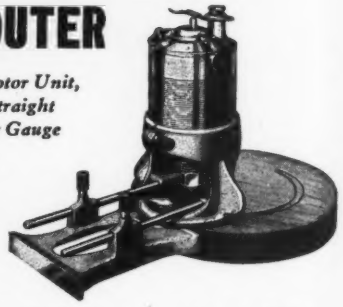

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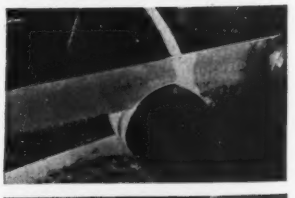

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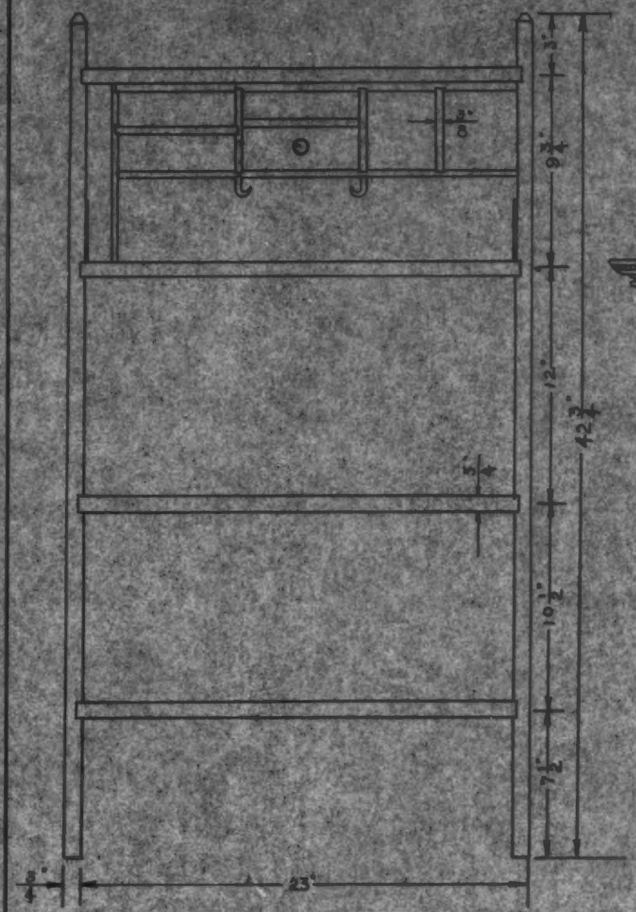

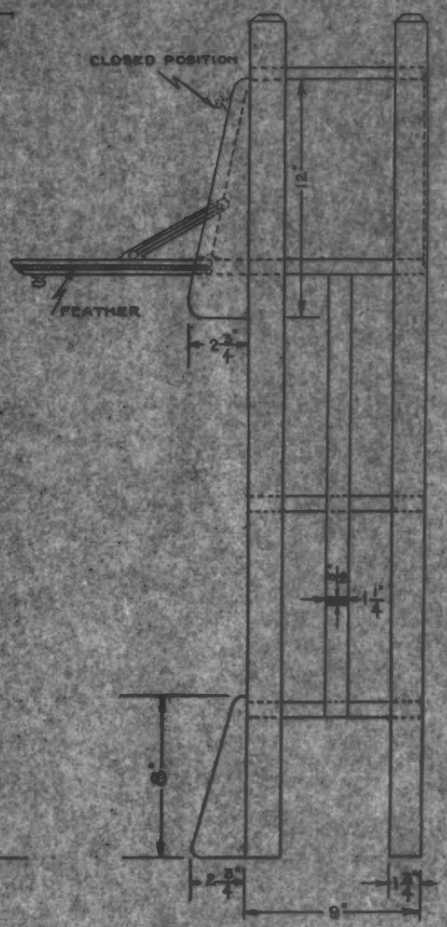

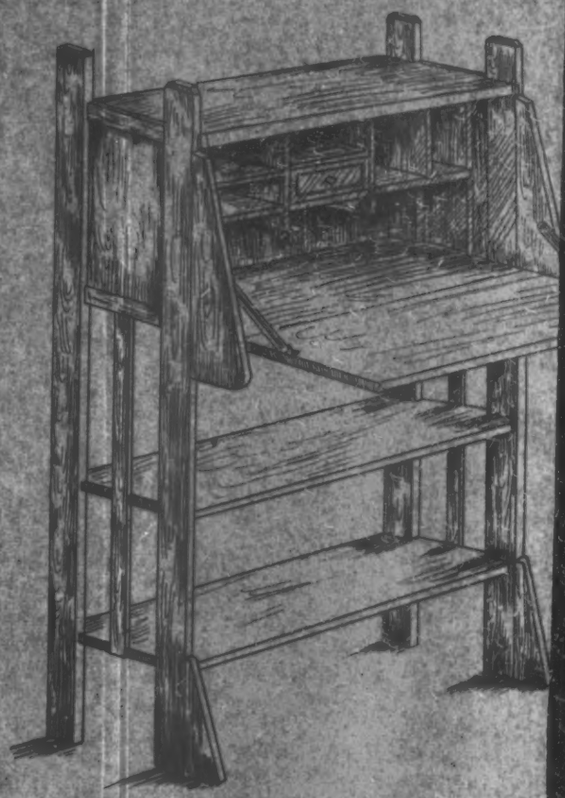

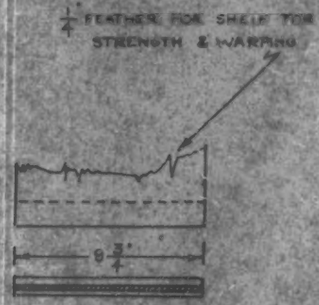

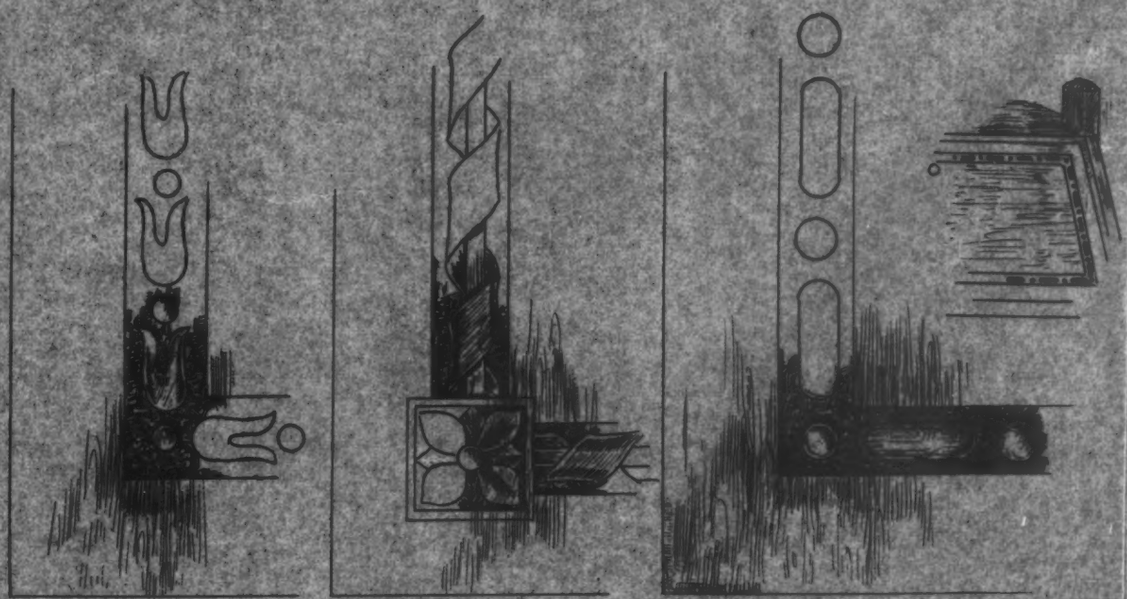

SECRETARY AND BOOKSHELF

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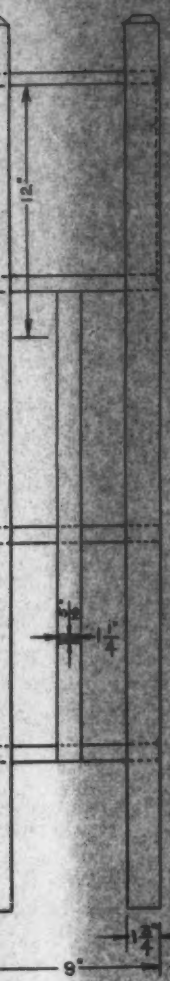
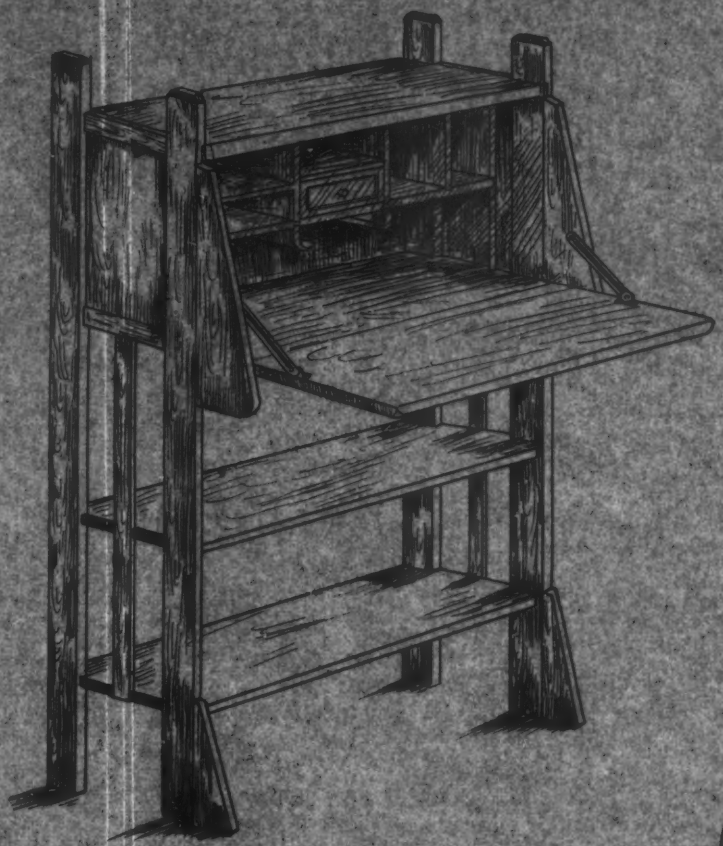
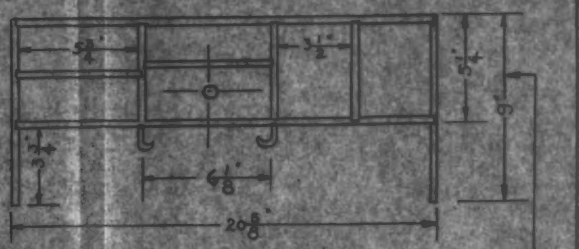
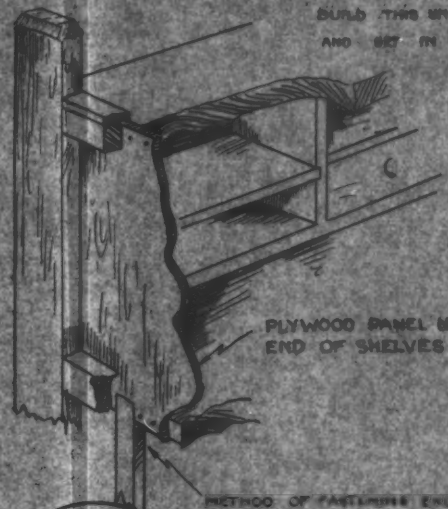




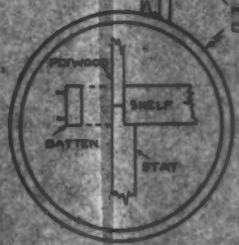


BUILD THIS UNIT OUTSIDE AND SET IN DESK



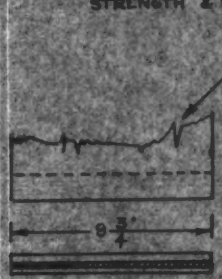
PLYWOOD PANEL NAILED TO END OF SHELVES

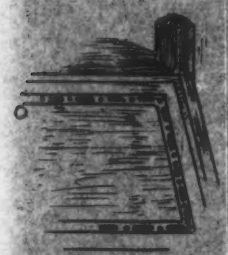
METHOD OF FASTENING END OF STAY.

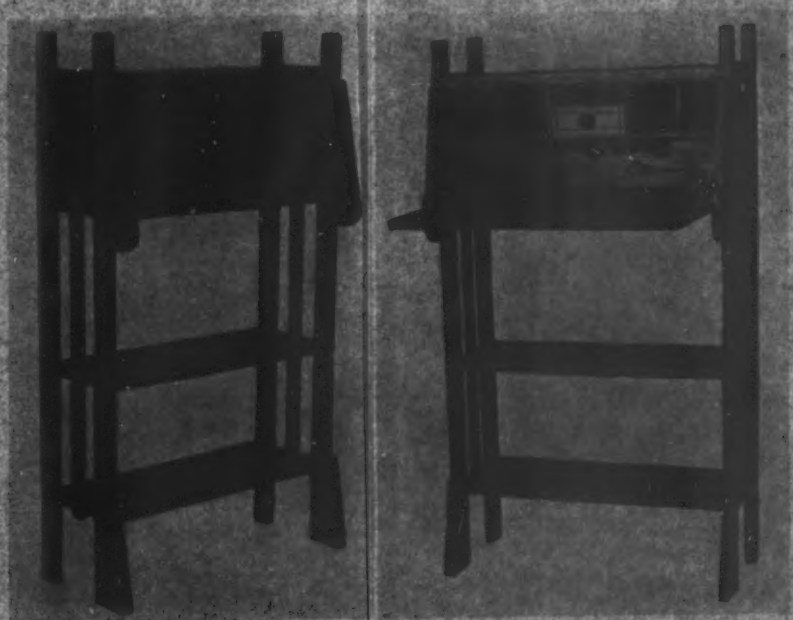


SCALE IN INCHES

¼" FEATHER FOR SHELF FOR STRENGTH & WARPING







SECRETARY AND BOOKSHELF

(See page 118 for description)

INDUSTRIAL ARTS and VOCATIONAL EDUCATION

April, 1937
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From Concepts to Techniques

Verne C. Fryklund

Assistant Professor, Industrial Education, University of Minnesota
Minneapolis, Minnesota

This excellent article shows how both the industrial-arts teacher and the vocational teacher must of necessity work toward the same goal — the education of the individual. (Author's address before the Michigan Industrial Education Society, Jackson, Michigan, April 25, 1936.)

Inasmuch as the interests of school-shop teachers are in both industrial-arts and vocational-industrial education, it seems only fitting that this article should be prepared in keeping with current interests of both groups. Emphasis may vary here, and it may vary there, but we are all engaged in a great ministry of considerable likeness, and the title "From Concepts to Techniques" involves many intriguing propositions that have been more or less vexing to both groups. The writer calls them "propositions," because he fully appreciates that individual experiences are unlike, and that judgments vary regarding conclusions. Therefore, what is written here may stand as a challenge to many and as a practical conclusion to others.

In Union There is Strength

Industrial-arts and vocational-industrial education, in their service to modern society, are complementary elements contributing to a great educational structure. There is no line of demarcation between them and their fusion is becoming more and more complete. Just as there is tendency to integration in all school offerings, so is there tendency to integration of these two branches of industrial education. They cannot be separate and without influence on each other, because all social experiences naturally are brought together in individual experiences. Variety of experiences results in variety of patterns in modes of living and in modes of doing. All life is like that; all life fuses. Nothing remains separated naturally. It separates only as people force it to separate, and so will industrial arts and vocational education separate only as their leaders keep them apart. This natural phenomenon of fusion is bringing them together, and today our leaders cannot keep them apart, nor do they wish to do so. In union there is strength, and with combined power there comes greater opportunity for social service and recognition for both groups. Our leaders recognize this virtue. There never has been closer co-operation between these two important branches of education than exists at the present time. There was a time when there was some measure of controversy. Tolerance of wiser heads has prevailed for the good of both branches. and we do greater good together.

This article, therefore, is written with a genuine appreciation for both of these branches of education, and the broader term *industrial education* will be used to refer to both. The writer is pleased that he has served both branches as a practical earner and as a teacher.

Concepts in Reverie

It seems trite to say that industrial education has social-economic functions just as have all other forms of education. Perhaps it is even more commonplace to say that we are a part, and an important part, of all education in its service to humanity. We have heard this so much now, that we all have come to believe it. However, these functions of social-economic service may be disregarded and therefore may not be effective if, in the turmoil of social change and its accompanying competition for leadership, stress is given only to concepts and not enough consideration is given to techniques for carrying out these concepts.

In education today, just as in politics, considerable attention is given to building concepts, but there is not enough devotion to procedures for bringing them to pass — not enough attention is given to techniques. To be more effective in social-economic service, we must emerge from our reverie in the realm of concepts and face the realities by improving techniques of attainment for the ideals we now embrace.

The Fundamental Content

One of these concepts concerns a problem of emphasis in subject matter.

For several years, there have been among us, persons who have urged an emphasis upon information to the exclusion of manipulative skills. This has come to be an enigma for those who would put this into practice. It is true that certain kinds of technical information are necessary in forming judgments in shop activities, and certain kinds of related or broadening information are desirable, but these are not fundamental to manipulative work. Manipulative work is fundamental to them, and therefore should not be subordinated. One cannot operate a lathe or a job press, weld a joint, make a drawing, or mend a screen, with information alone. Manipulative work is still the fundamental content in shop learning and will continue to be so. Those who emphasize information should realize that there is no reason today any more than in the days of the apprentice crafts for tolerating shoddy workmanship. To stress information first is to ignore craftsmanship. To ignore craftsmanship is to ignore that phase of creation which combines with art to make the realities of everyday living.

It is the writer's belief that those who have been stressing the informational side of shop learning to the exclusion of handwork, have been actuated, first, by a misconception of the meaning of culture in modern education. Emphasis on information does not necessarily make the work more cultural. Culture is individual. It varies with combinations and various modifications of personal qualities. In one person culture would be manifested through manners and social poise, in another through exact knowledge, in a third through vocational accomplishment, in a fourth through appreciation in the arts, and so on. There is no standard of culture for everyone. It can be said that a thing is cultural if it adds to the art of living. So, therefore, we need not be influenced by any belief that cultural values are lessened by giving important place to handwork in the school.

A second reason for advocating stress upon information comes from the fact that it makes a good defense for those who themselves are not fully trained and are unfamiliar with the true meaning of craftsmanship. This is common among shop teachers whose manipulative training is inadequate. A third reason for stressing information so heavily is the assumption that parents and general educators like the emphasis. This is without foundation, inasmuch as we are now in an era of revival of interest in the utilitarian and fine arts as cultural agencies for all people, and not merely for the few.

Not long ago, the writer visited a teacher in elementary mechanical drawing, who in presentation to his class made the statement that their primary objective was to understand *how* rather than to develop technique in drawing. In my judgment it was unpsychological to make such a statement in connection with a subject in which every line and its form has meaning. It is true that many boys cannot attain a high degree of skill in shop activities; there will be individual differences, but ideals must be held before them nevertheless. These ideals provide information regarding practical industrial conditions and standards of requirement and, therefore, they have important guidance value. If the teacher must tolerate a certain degree of shoddiness because of the total inability of a learner, let that be in the mind of the teacher, but he should not belittle the ideals of craftsmanship before the learners as a group.

There is danger, in stressing information, of embracing responsibilities of instruction which belong to the social sciences and general science. We should do well to consult our colleagues in these areas and share responsibility with them because they are exceedingly well prepared and do teach many of the topics of information which we may feel obliged to include in our courses. Indeed, that they are now doing so is evidenced in many courses in print. There will remain an abundance of necessary subject matter of which we may be proud. There will always be a certain amount of technical information that must be taught, and taught well by shop teachers in order that the manipulative instruction may be effective. Besides this, there will be taught a residue of general information, or elements which, though not technically necessary, enhance the value of our subject.

Artist and Artisan

It has been already been stated that we are faced with a revival of interest in the utilitarian and fine arts. It is exceedingly difficult to accept any concept that does not bring the utilitarian arts and the fine arts together. They fade into each other; they fuse, as it were, as does all human activity. There is no line between them because, together they constitute craftsmanship.

Teachers in both areas must consider each other as professional associates because construction and design cannot and must not be separated if craftsmanship is a worthy ideal. The fine arts must be more useful, and the useful arts must be more refined. Both artist and artisan labor with similar materials, and the difference in the products of each is in the amount of thought, labor, and skill expended upon them. The printer, the cabinetmaker, the metalworker, and the tailor are genuine craftsmen when their skill is joined with art; when proper time and effort and thought are used in the fashioning of a particular commodity. There must be union of these important school and community services. Stimulation for their closer association must come from teacher-training institutions as well as from teachers and organizations in the teaching field. However, the responsibility for initial training lies with the teacher institutions. We appeal to them, for they provide initial stimulation of concepts in young teachers, and it is they who must indicate the techniques. This calls for constant change in curricular planning and instructional procedures in keeping pace with the needs of education in order that education may better serve society. From these efforts, we may expect the artist and the artisan to unite in their efforts in producing craftsmanship in educational planning, craftsmanship in teaching, and craftsmanship in structural creation.

That We May Walk and Talk

An important avenue of success, in proceeding from concepts to techniques and in attaining recognition and furtherance of industrial activities as important social-economic functions, has slowly but surely come to the fore during the past decade. There comes recognition and opportunity for co-operative planning when industrial teachers can walk and talk with administrative officers regarding common problems such as curriculum construction and course organization, school organization and school finance, guidance, and pupil-personnel management. For any teacher to be able to participate in these important phases of school operation is commendable, and it places him in a strategic position to attain desirable subject-matter advantages as well as render useful personal service. It opens the way for expansion and enrichment in all subjects with which he is directly connected. Such participation is the concern of all teachers.

The modern industrial teacher, in his work toward advanced degrees, avails himself of opportunity for training for broader usefulness. Certainly the broadening of personal and subject-matter service cannot mean only more and continued training in the same thing, but it must mean also an expansion of interests and training in other phases of the larger educational program.

By way of illustrating the practical usefulness of a study of one of the aforementioned problems, it may be said that modern procedures in curriculum construction provide many techniques available in the realization of concepts. There is yet to be considerable advancement in the development of techniques for course building, and ultimately in the realization of the concepts which have to do with aims of education to which industrial subjects can make excellent contribution. It is doubtful whether direct attempts to match aims of education by any subject would be successful. The procedure must be indirect and, parenthetically, it should be mentioned, that subject aims, conceived alone without consideration of general aims of education, may lessen the extent of the subject contribution to the general plan of education. If industrial education is an important part of the general plan, then there must be connection with general aims of education in the development of specific subject aims.

The Course of Study

It is through the course of study, made effective with good teaching, that concepts are changed into realities. In building a course of study, it is necessary to start with aims, because aims give us direction, they tell us where we are to go and when we have arrived; they tell us what subject-matter content or instructional units to choose that will best contribute to realization of the aims; they help us in choosing methods that will be most effective in instruction; they help us in conceiving plans for measuring results of instruction.

In making the course of study, therefore: (1) Let us begin with a set of aims of all education, agreed upon in advance. Any set of aims for education would be curriculum aims attached to no subject in particular; they would be general and, therefore, would be for all subjects combined. (2) Let us study and analyze the general aims and out of them conceive aims for industrial education. This new set of aims would also be too broad for immediate usefulness in any particular industrial activity. There should be further analysis. The subject aims should be even more specific than are the field aims. (3) From the field aims, then, are made the subject aims, or working aims. Figura-

tively we examine the general time table of travel, determine upon a destination and then choose the content for our traveling equipment. Literally, we choose such content for the course of study as will make best contribution to the subject aims. This content will consist of the instructional units in terms of things to be done and things to be known which we believe will make best contribution to the attainment of goals. To reach our educational destination, the next step is the mode of travel that will most economically take us from where we are to where we are going. In course organization, this mode of travel is by way of methods of instruction. It is good method that provides the means of getting the subject matter across to the learner; it is a vehicle for contributing to the aims of the subject. The next step is to determine how well we have taught, whether we have arrived; testing helps to do this. Measurements, therefore, should be included as a last step in course organization.

The outline above presents one of the most useful of educational devices for changing concepts into realities. If all subject-matter fields in education would follow such procedure, there would be more unified thinking regarding education; there would be more integration.

Teaching How to Think

Then there is another concept deserving of attention when considering techniques of attainment. Much is said about development of problem-solving abilities as outcomes of all teaching, but to identify the incidence of problem solving in shop teaching seems difficult. In the shops there are problems in abundance; there is no end to the opportunities available to train youth in developing initiative of the kind necessary in solving problems peculiar to the shop. There should be little sympathy for shopwork where there is nothing more particular to do than just to make things. This too frequently amounts to puttering and leaves no real opportunity for training in problem solving.

In industrial work there are problems as there are in mathematics; and there are fundamentals which in various combinations are necessary in the solution of these problems. The problems in shop teaching are the jobs or finished projects, and the fundamentals are the operations and technical knowledges. A combination of manipulative operations together with necessary technical information forms the solution for a particular shop problem. The operations and technical topics, inasmuch as they are constants, are instructional units. They must be taught by the teacher just as the operations in mathematics must be taught by the teacher.

It should be the learner's responsibility to plan his own procedure for every project he undertakes in the shop. He should list the major steps of construction in their sequence and list the necessary tools. He should read the drawing, make his own bill of material, and determine the costs. This should be done on note paper or on a special form so the instructor can check it carefully to see that the learner has planned properly. It is by means of this written plan of attack that the teacher determines how well the learner has thought through the problem from beginning to end.

Such planning involves reasoning of the highest type. It is just what anyone who is doing creative work must do when attacking a problem. The lawyer, engineer, architect, teacher, orator, musician, mechanic, artist, and others who do creative work must plan carefully before starting new tasks. It is true that pencil and paper are not always necessary in planning procedures in the world outside of school, but in teaching it is not possible to depend upon the learner's oral expression in the matter and, therefore, it is necessary to have a written form. The written plan serves as a means of "tuning in" on the learner's thinking. After satisfactory experience in planning and when certainty is established as to ability of the learner to plan systematically, it would be well to eliminate the writing feature inasmuch as the writing usually cannot be continued in practical affairs.

To train learners in planning procedures is to train them in problem solving peculiar to shopwork; it is that phase of the work that provides opportunity for training youth *how to think* in shopwork. Thus in shop procedures, training in order to learn how to think should start with the beginning projects, and special attention should be given to planning so the beginner can learn to plan just as he learns to perform operations. This is so important that the teacher should teach how to plan procedures just as he teaches how to perform operations.

The learner should be taught early that ability to plan systematically is highly essential to success in the shop. He should know that he is to be held responsible for what he has learned and will be required to draw upon his accumulated learnings in planning every subsequent project he undertakes. The extent and thoroughness of his mastery, and good judgment, will affect the speed and thoroughness of his planning. This is not to say, however, that the learner must make a job analysis of each project. This assumes training in trade analysis that he has not had. He may have been taught in units, but just as other learning integrates in the nervous system so will the units of instruction fuse as they are learned. He should be required to list only the general steps. Several units may be combined and no two persons may plan exactly alike, although the general plan may be the same. *Everyone* learns in patterns and these patterns are drawn upon in solving problems. And so a boy draws patterns of action from his learning in making plans of procedure.

Analysis and Pattern Learning

It may be well to take a brief glance at *Gestalt* Psychology and its probable influence on industrial teaching.

Not long ago, a speaker was heard to say it was his opinion, and that of others, that the principles of industrial teaching which embraced the operation as a basis for the unit of instruction was a thing of the past according to modern psychology and that generalized organization was coming. After considerable exchange of thoughts it was discovered that somewhere he had read that psychologists are looking favorably toward *Gestalt* psychology. This is a pattern psychology which says that we learn not by response to single stimuli, one at a time, but to several stimuli in the form of patterns. It is said that these patterns integrate or fuse in our nervous systems, and in solving problems we draw patterns of response rather than a single response at a time. We can all agree that this is a practical psychology. Its principles underlie the suggestion that when planning procedures, one should not expect a learner to make a detailed job analysis. He should make and will make his plan of action in work patterns.

However, all this does not conflict with the fact that there are and must be units of instruction; that there are fundamentals to be taught. A teacher cannot and should not teach problems. The problems are to be solved by the learners as they draw patterns from former learning, and combine them into new patterns as solutions for the particular problem in hand. A unit of instruction in shop teaching is not a single stimulus; it is a complexity of stimuli; each unit is a pattern. The more advanced the work becomes, the larger the instructional units and the larger the patterns. In elementary learning, the patterns are small and new ones are formed and reformed with experience. And even though a single pattern may seem small, its constituents may be hundreds of stimuli affecting the eye, ear, nose, and skin; and these together with the influence of the muscles and glands, form patterns that may again become elements of other responses at other times and in other situations.

There is no conflict, therefore, between the principles of pattern psychology and

the principles which indicate that there must be fundamentals as a basis for teaching. When there is something to be learned, there is something to be taught, and no more should be taught at one time than can be learned at one time. *Gestalt* psychology is merely a good explanation of how we learn under whatever plan of instruction. It does not say that lessons in industrial teaching are too small, nor does it say that instructional units must be discovered by learners. Before units of instruction were the basis of teaching in shopwork, there was confusion; and certainly no one would consider going back to that aimless, puttering stage of our existence.

It was said to this speaker that industrial teachers regarded *analysis* as an institution; and it is one of the best devices that we know for making concepts into realities in industrial education. And a misconception of the meaning of pattern psychology on the part of a few who know little about the meaning of analysis and psychology as well, would not change the obvious; it would not change the axiom that when there is something to be learned, there is something to be taught; and the instructional units must be identified before they can be taught.

Concepts are always necessary, but let us not be too quick to question the value of existing procedures in our preference for attractive headlines and catchy phrases. Let us get into the habit of seeking principles and techniques to accompany these growing concepts. Unfortunately, in our everyday ministry to youth, we frequently fail to seek objectively to connect cause and effect in order that we may better serve that youth.

The Excellent Teacher

Even when we conceive well and plan well for carrying out these concepts, unless consideration is given by the individual teacher in this planning, success will be doubtful. It is the individual teacher who makes a plan work or fail. There are many plans of organization for shop instruction; there are shops and there are laboratories; but whatever the plan, it can be an excellent one if it is in the hands of a teacher who is well trained and thoughtful, well fortified with a repertoire of techniques, and who has the urge to succeed. In other words, in the hands of an excellent teacher, shop or laboratory must needs be excellent, too.

Social Security and Industrial Education

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A thoughtful discussion on the opportunities with which teachers of industrial arts and vocational education are confronted at this time.

"Industrial education" is here referred to in its broad meaning, namely, any and all educative experiences which are concerned with the various aspects of the trade and industrial occupations. It includes the industrial arts of general education, and vocational industrial education which is specialized. Its outcomes are classified as manual skills, information, appreciation, ideals, attitudes, and habits.

"Social security" is likewise referred to in its broad meaning. This includes the economic, political, religious, occupational and personal aspects. All of these phases affect our social order.

Industrial Education and the N.E.A. Committee's Social-Economic Goals

The challenge to industrial education may be made in part at least through the question, "Wherein and to what extent does this area of education contribute to the ten objectives set up by this committee?"[1] Note the following ten objectives and particularly those italicized: (1) Hereditary strength, (2) *physical security,* (3) participation in an evolving culture, (4) active, flexible personality, (5) *suitable occupation,* (6) *economic security,* (7) *mental security,* (8) *equality of opportunity* (according to capacity), (9) freedom, (10) fair play. Unless industrial education can make substantial contributions to the achievement of some of these social-economic goals, it has little place in current education.

Industrial Education a Logical Development

Up to recent years, vocational education of all types, including industrial education, at all school levels has been developing according to a rather definite scheme which may be outlined as follows:

Period	Outstanding National Ideal, Purpose or Characteristic	Educational Emphasis in Schools (Chiefly Secondary and Higher
Colonial	Freedom of several kinds	Religious, with the aid of the three R's
Civil War to 1929	Greatness and power in physical things	Scientific, through the development of an individual's mental powers
Since 1929	Security of all kinds	Vocational or specialized, with a proper balance of the cultural and civic

We ask but one question at this point, "Is industrial education keeping pace at this moment with the outstanding developments in industrial life, with the economic, the social, and the personal rather than the material?" An analysis of the answer to this question follows shortly.

Industrial Education Has Modified Itself in the Past

Earliest industrial education in the United States was frankly vocational. It followed in the movement for mental discipline, then it became dominantly cultural with emphasis first upon the design and creative side in "manual arts." Later it turned to consumer's appreciation, aid to guidance, and the child-centered school aspects in "industrial arts." Next followed a complementary aspect that has been wholly vocational. Emphasis in the vocational aspect is now changing somewhat from the youth and preparatory training, to the adult and preparatory, extension, and retraining.

Must Contribute to Social Needs and Well-Being

Industrial and any other phases of education will rise or decline just about in proportion to their contributions to present-day needs of education in an industrial-democratic society. These changing concepts of educational contributions do not necessarily mean a new group of aims. Frequently they mean only a careful analysis of existing aims and a reassignment of emphasis. Very few teachers and leaders have sensed this rise of socio-economic emphasis in industrial-arts and in vocational-industrial education for about fifteen years. Some modest beginnings have been made. Yet, a vast majority of leaders and teachers of industrial education do not at this time recognize problems of management, production, labor, ownership, health, training, wages, retraining, financing, raw products, distribution, and *the*

[1]Published in the January, 1934, *Journal of the National Education Association.*

now rising voice and leadership of workers of all kinds in local, state, and federal government, as important phases of "industrial education." A few hold that for the future welfare of the state, society, and the individual, these phases of industrial education are equally important with manual skills, knowledge, information, and attitudes.

"Vocational education should aim to develop an appreciation of the significance of the vocation to the community, and a clear conception of the right relations between the members of the chosen vocation, and between different vocational groups, between the members of the chosen vocation, and between different vocational groups, between employer and employee, and between producer and consumer. These aspects of vocational education, heretofore neglected, demand emphatic attention."

You may say that the foregoing are recently stated words. If so, you are wrong. They constitute the third paragraph of the fourth objective (vocation) of the *Cardinal Principles of Secondary Education,* the epoch-making educational statements of the special N.E.A. Committee of 1918. Nineteen years ago! How little we have advanced in *this* direction. And you will say, I am sure, that the words of this quotation are many times more significant in 1937 than in 1918.

Industrial Education as a Social Science

Education as a whole is to a considerable extent a social science. Today, all progressive educators insist that all "subjects" and school activities must contribute what they best can, to the social unfolding and development of students. The so-called social studies cannot do the entire job adequately. Industrial education's contributions in this direction are peculiarly significant for three reasons: (1) Trade and industrial life now dominates the social, economic, and political life of the nation; (2) one half or more of all boys and girls who will be gainfully employed will work in the trades and industries; (3) *the methods of learning, technical procedures, materials, equipment, and products are experienced in lifelike situations either real or very closely approaching actual life conditions.* This latter condition provides a real rather than a pseudo or hypothetical setting for the study and discussion of socio-economic-occupational problems of current industrial life in America. Call it correlation, tie-up, or partial integration. Who *should* be able to interpret industrial life better than the industrial teacher who has experienced it, provided of course that he has the necessary background of pertinent knowledge, appreciates its significance, and desires to present it acceptably?

Specific Contributions of Industrial Education to the Current Socio-Economic-Politico Occupational Scene

Space here does not permit differentiation between the particular contributions of industrial-arts and those of vocational-industrial education. Neither is it possible here to discuss at length the several types of educative experiences itemized in that which follows. One must admit that all of them are socially desirable, helpful, and necessary for many. Likewise, all of these educative experiences have been provided either by a few or by many far-seeing teachers and leaders. They are not "new." The important consideration is the degree of emphasis and the way they are provided.

1. Industrial arts is mandatory in some degree and in some phases for all boys and girls. It is a great social leveler through common adolescent interests. It provides an insight for all into the mass movement that dominates American life today. For many it shows how the other half of the world lives. Youths "on the other side of the tracks" have opportunities to mingle in joyous experiences as nowhere else.

2. Industrial-arts and vocational-industrial education, and in fact all practical arts and vocational education, constitute the only remaining *school experiences* which embrace the most fundamental method of education, namely, learning by a combination of seeing, hearing, thinking, and doing. An education which is composed of the recorded experiences of others is unreal. *An education of ideas only is socially dangerous.*

3. Industrial education abounds in opportunities for creative thinking or problem solving. Together with agricultural education, it gave education as a whole the project method. Through the teaching-learning methods used, there is opportunity for self-direction and initiative. An attitude of inquiry is stimulated. The results of thinking and doing may be measured objectively. In the past a few leaders have applied this "scientific method" in material and physical developments. Here is an opportunity for many to have practice in the use and application of a much-needed procedure in more aspects of our current national life.

4. Industrial education is the most extensive and the most available vehicle through which desirable correlations of subject matter and the beginnings of integration can be made. It is so used by progressive school administrators and teachers. Here is provided an excellent agency for personnel experiences in interdependence and co-operation. Americans are just beginning to learn that they can no longer build their homes where they cannot see the smoke of their neighbor's chimney.

5. Industrial arts, particularly, provides avenues of self-expression. This is true for both youth and adult. It provides socially desirable free-time experiences in avocations. It frequently provides an "escape" for the mental worker and a pleasurable diversion for craftsmen who may not get any personal satisfactions out of their mechanized work. The variety of materials available makes the appeal a broad one.

6. Industrial education in which exploration is emphasized has real social value. A person who has found an occupation in which he secures satisfactions beyond the pay envelope and who has reasonable security of tenure and a saving wage, is not susceptible to extreme and radical doctrines. Occupational satisfaction usually comes only when an intelligent occupational selection has been made. In this, the first steps are to secure knowledge about occupations and self. A guided and real experience is superior to knowledge gained solely from words or pictures. We know better if we have an occupational aptitude or possess some actual skill in accurate modeling, machine tending, assembling, picturing, or repairing if we actually "try our hand" at it for a reasonable time. This exploring may lead directly to vocational training or entrance, or it may lead to further educational preparation. Such education is now very generally accepted. Some persons are led toward industrial occupations and others away from them. In either case, the object is achieved. Obviating the placing of square pegs in round occupational holes is a public problem and responsibility.

7. Vocational-industrial education fits for successful entrance upon wage-earning industrial occupations. It also supplements daily employment of youths and adults. It re-educates victims of technological changes and industrial hazards. It becomes more dominant in secondary and higher education. Its best friends wish it adequately tempered with cultural and civic education. Congress has just given further approval of its social and public worth in the passage of the George-Deen law which supplements, broadens, and strengthens the original vocational-education law.

8. Industrial arts adds to culture, and home, and other satisfactions when the consumer-appreciation aspect is emphasized. To appreciate, demand, and consume products of crafts and industries upon the basis of excellent materials, workmanship, and structural and aesthetic design provides cultural satisfactions for the consumers, and more and better production for industry and workers.

9. Industrial education, both the arts and vocational, has splendid opportunities in it *through applications* (work experiences, equipment, supplies, and products) to give pointed appreciations of, and significance to *principles* of sociology and economics involved in industrial conditions and problems such as the following: Mechanical production, ownership, management, labor, organizations of employers and employees, production costs, sales, selection of workers, training programs, health and safety, employee representation, wage levels, determination of wages, cost accounting, raw products, distribution, advertising, overhead costs, quantity production, craftsman production, co-operatives, and legal aspects such as federal old-age and unemployment insurance, child labor, part-time education, joint apprenticeship agreements, compensation for injury, safety and health regulations, and possibly others.

The Public-School Teacher

One may well ask who is in a better position to, and who can, teach such important facts better than a public-school teacher. And who of these is in a better position than the teacher who represents trade and industrial life? He owes allegiance neither to employees nor employers, but to the public at large. His contacts with trades and industries give him the point of view of the worker. His study and observation and possibly experience give him the employer's point of view also. He is in a key position. He may do much of real social worth if he can get all of his pupils to see that there are two sides to all industrial questions. He can do much with many of his students who will enter industrial life. These persons, together with those in agriculture, will shortly select or become the workers' leaders who are rapidly assuming greater social, economic, and political leadership and control in industrial, state, and national affairs. Shortsighted, harsh, and callous leadership of workers is just as disastrous to them and to the nation at large as shortsighted, selfish, and headstrong leadership of those who own or manage capital has been at times to them and the nation. All of this is "industrial education." It is of the most vital sort. It is sorely needed. What a challenge to the leadership and the teachers of industrial education! Are they ready? Most of them at present, are not.

To bring about these neglected aspects of industrial education demands are reshaping of preparatory professional-teacher education for industrial-arts teachers and vocational-industrial teachers. It means in-service training with change of emphasis for those already teaching. This is needed to help the teachers keep abreast of current trends and developments.

"Democracy's High School Should Train Its Pupils for Economic Efficiency, Good Citizenship, and Complete Living."

— Entrance Inscription, High School, Lock Haven, Pa.

Where and How These Aspects of Industrial Education May Be Taught

This discussion should not terminate without a word to indicate how these developments can be accomplished. In industrial arts there is ample opportunity to include short lessons covering some of the above aspects of industrial life under the nonmanual aims recognized by all progressive teachers. From one fifth to three eighths of the total time is now assigned to such phases. Lessons may be formal or informal and either short or long. Almost all of them can be tied into educative work experiences.

In vocational-industrial education, the modes of instruction are much the same. Opportunities appear in the conduct of the manual instruction, and in related studies in science, mathematics, and drawing, and again in social studies, English, and health.

Where there is vision and determination, a way will be found. All that is necessary is a recognition of the need for a *re-emphasis of present aims,* supported by modified subject matter and courses of study. These concepts of industrial education are not fanciful or ephemeral. A *few teachers and leaders* with a sense of current developments and values have been teaching *some* of these social aspects of industrial education for fifteen years!

Current Comment No. 11

Three Teacher Types

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Another thought-provoking article belonging to this "Current Comment" series.

It is often appropriate and effective, in public address or in writing, to present an analogy. Two conditions or circumstances which resemble each other can be associated so that the combination will "make a point," insure its recall, and suggest worthy reaction to what may be implied. The parallel or correspondence between the two elements need be neither perfect nor complete. It is necessary only that the two parts be similar, and that the one of first mention be of rather universal character and generally accepted or conceded. The writer has been thinking that the attitudes and habits of people regarding the dictionary are analogous to the efforts of teachers as to self-improvement and the advancement of the profession.

A host of individuals seldom, if ever, use the dictionary. They have no interest in, nor conscious need for this mine of information. Most of them know that the book exists and have, in school days and after, taken infrequent peeks, but they have no concern about its full content nor about how it might help them in the run of the weeks and years. To some people many words are no better than few, vague definition is not disturbing, faulty construction is no crime, and fine shades of meaning have no virtue.

Other persons, a smaller number, use this wonderful book when in trouble and only in a half-hearted and shrinking way. They never attain much ease in its handling nor much satisfaction from its service. They ask little, get what they ask for, and are often content with less. Sometimes they seem to resent whatever or whoever has forced the contact, because they want to remain as they are. They may own the book, they may suffer it to be known that they occasionally use it, they may even arrange to be seen "going through the motions" that are assumed to be proper. They belong to a middle class, not wholly unaware but unappreciative. They use the dictionary sparingly and under constraint. Later they either drift back and mingle with the crowd earlier described or they increase the pace, take new ground, and experience ever widening mental horizons.

Still others, a select and enlarging group, use the dictionary continually, with zest and with high return. They know that good expression is an asset for most anyone in most any calling, and that he who wills to attain it, is likely to be favored. They sense that the book has a dozen uses

and that it pays cumulative dividends. They learn that its value is directly dependent upon the understanding with which one consults it. They appreciate that the best educated among us use it most. Becoming interested in this inverse truism, they are stimulated. They wax prideful as they feel their progress and are surprised at the simplicity with which they have come to a measure of mastery. Their new standards are comforting, also, in that by helping themselves they have made aid to others convenient. Almost unawares they regard a less worthy past as having been abandoned and a better future as increasingly probable.

These three groups are not distinctly separated; they overlap or merge, the one feeding or growing into the other in upward trend. Through broadening the vocabulary, becoming more exact of thought, and improving English style one makes a certain and gradual advance. The use of the dictionary is a developmental matter. So, among teachers, the acquirement of professionalism is a plan and a project of growth.

Some teachers seem, without being unsocial, to live in a world apart. They fraternize with pupils and colleagues and with others in the community, yet they do not gravitate to those of their very own. They do their daily work with some success but seldom as if they really knew its function. On and on they go with little change, little gumption, and little chance of improvement. The free time they have is used for purposes quite divorced from the very work upon which they depend. Whatsoever things are new and bright and current in the field do not trouble them. What others think and do and crave does not excite them. Perhaps they grow weary and sluggish and snarlish. Perhaps they come to fear hurtful comparison and look about for unwarranted protection. They shun the ones who could help them most and who would be more than willing. For such teachers, there is neither hope nor need. They will continue to have low-grade tasks and will continue to complain about their circumstances. Their aims are low, their sights are defective, their visions are poor, they shoot in mixed directions. They should be forced to understand that howling and higher ranking do not hitch, that in education as elsewhere, money and management are things of merit. After fair effort toward improvement their superiors have clear and unquestioned duty, for few will quit of their own accord. The lack of attitude and of ambition in a teacher is worse than the lack of training. Pupils have lives to live, and parents have claims and hopes that no one has right to discount. Progressive spirit is a thing of weight and those without it should be classed as weeds. But why go further with this picture, a mean indictment of our schools? None who are meant will read these lines and there are different types to restore our faith.

Other teachers, in much greater number, seem willing to do and to be what they think is with logic demanded. They try to learn what their elders or betters are "up to." They edge into meetings of formal kind where absence would be noted, and they place their names upon certain rolls where action to the contrary might need to be defended. New things in line with their work come largely second-handed. They let the other fellow read the books, and take the courses, make all the trials, and work upon the plans. Secretly admiring and grateful, they then resolve to be his friend and so remain until the awful day when through his efforts he receives some boon. They avoid responsibility, seem ashamed to speak the language, do not club, confer, or seek with any flash. Always lagging, they feel driven as are all who never hold the reins, even for a day, upon themselves. In amateurish way, and yet without apology, they work and wait; they never bear good tidings nor help to set the stage for better things. Friendly, but in least helpful places; gaining, though by sporadic means, these people linger always on the fringe and fail to help the cause to which they cling. For such teachers we have sympathy and will, when privileged, lend a helping hand. They are not deep down beyond recall; they strive in quandary why their efforts fail. These must be found and brought along to comfort, then to action, and to place. Ability and will to do are theirs; they need to know the way to reach their own. Dormant here are needed talents and our chance to aid is ever present.

A higher group we know with joy. Their teachings they associate with aims of subject, school, and movement. They take a part, nor wait to be compelled. Slight urging will suffice and every clue is canvassed for such of progress as it may afford. In meetings they participate because they are full and because current problems are not strange. They read and think and often write what others read with profit. Committee work and like endeavors seek them out because their ease and readiness have somehow been assured. They organize and push along because they know that mixing gives one strength and that to run alone may call for less. Ever active for improvement, they surround themselves with people and with things that stress their field. They cannot wait to come to know by hearsay; they must be present when the deed is done. Rarely at rest and often nervous, they sense that learning and advancement can be earned and that true peace is rarely gained except by storm. Weary, yes; carefree, no; but what of these when a pattern has been proved? On, up, ahead, they see the one whom they admire, those who have lived their route and call it good. They rate themselves and check their work. They study by such means as are at hand. More training of the kind preferred becomes an aim despite prevailing odds. They know that moving up makes call for nerve and fortitude; that professional worth is more than compre-

Oiling harnesses. A practical job in farm mechanics
— Photograph by W. E. Crabtree, Milton, Oreg.

hension; that those who have arrived are commonly unselfish. We need not worry about such teachers. They are happily on the way with plenty to be done. They are our leaders for the future, they are the ones to see and to encourage. Work that has been difficult and slow and tricky for those of us who are older will be to them as play, a passing obstruction in the new and broader path. Their preparation and their morale may well be our best service.

Guidance: Educational and Vocational

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The true extent of guidance must include in its scope vocational, recreational, social service, and character objectives.

Guidance has always been an essential function of education. It has been, too, a conscious aim of education. But in our love for novelty — even if it is only the novelty of a word — "guidance" has become a fashion along with other old timers like "character." It is fortunate we have these social words for it gives us opportunity for re-emphasis on abiding verities.

Education — is it not a platitude? — is a matter of the self-activity of the individual. Teachers, textbooks, and all the other school aids are merely aids. The teacher's function is essentially one of guidance — to give direction, if possible, to the self-activity. To what? To the highest and best and broadest education that this particular individual, John Smith, is capable of — nothing less than that. Stated in another way, it means the efficient, socially minded workman, the good citizen, the true Christian.

Too often vocational guidance has aimed only at one aspect of this trinity. It has aimed at the workman. Its job has been merely placement to bring a man-out-of-a-job and a job-without-a-man together. This is a useful, social function, but as mere placement it is, if anything, only a very minor function of the school. It is often not guidance. It is not educational.

Too often so-called vocational guidance has taken on a character of predestination. It has been a kind of education Calvinism. Pseudo-experts have presumed to judge for as yet unformed adolescents their educational destinies. They have no humility, no reverence in the presence of yet unformed or undeveloped human power.

Fortunately the leadership in the movement of vocational guidance has recognized the grave responsibilities which are involved in decision of vocational guidance. The basis of such a decision must include a wide-ranging knowledge of human nature and of the individual to be guided and a comprehensive knowledge of the socio-economic order in general and in the particular city or region.

In its statement of principles the National Vocational Guidance Association has stated with great insight and courage what is truly involved in guidance. Two of these principles we shall discuss here. The first we shall state in the words of the Association.

"No two individuals are identical in natural endowment or environmental conditions. Every effort must be made to know the individual, his intelligence, his special abilities, his understanding of work, his health, educational achievement, work experience, temperament, character, interests, and his social and economic situation. These individual differences call for individual attention. To provide equal opportunity for all, it becomes necessary to accord separate treatment to each."

Just note the list of what should be known of the individual. They are tabulated here for effect:

Intelligence	Work Experience
Special Abilities	Temperament
Understanding of Work	Character
Health	Interests
Educational Achievement	Social and Economic Situation

Truly this would be an adequate basis for any guidance of an individual. However, we are too likely to mistake some "snapshot" test or some incidental report of a teacher for the human reality about the individual. Even after we have such imperfect knowledge as we can get of these factors it is still a tremendously difficult responsibility *to help the individual* make his choice.

But let us look at the social side of the picture. The Association states the social basis for guidance in its second principle as follows:

"The advancement of science and social and economic changes make it increasingly difficult to be familiar with all occupations in their diversity and in their degree of specialization. The nature of the actual work to be done, its educational requirements, its demands on health, intelligence, special ability, temperament and character, the opportunity it offers for training and advancement, the remuneration, the working conditions, and the importance of the occupation and of the industry — these elements need to be known for specific occupations. This information should be supplemented by a knowledge of educational institutions and of the type of training they offer."

Notice in a list form the essential knowledge of the social side of the problem:

Nature of Actual Work to be Done	Opportunities for Training
	Opportunities for Advancement
Educational Requirements	Remuneration
Demands on Health	Working Conditions
Intelligence	Social Importance of Industry
Character	Social Importance of Occupation
Temperament	

With such a knowledge of the individual and of industry truly vocational guidance becomes in a genuine sense a humane thing. It recognizes education as well as vocation as humane. This is notable especially in the other principles listed on the statement of principles that absolute freedom of choice is the inherent right of the individual. It is important that in the field of vocational guidance this humane point of view shall dominate. This is especially so as the tendencies of industrial organization are more and more dehumanizing and depersonalizing.

This last point suggests that for an age proposing a five-day week and a six-hour day that the important guidance will

be the leisure-time guidance program for the individual. This should be now an important part of a comprehensive guidance program. Its present failure is indicated by the futility and triviality of the leisure-time occupations of contemporary life.

Even today the choice of a vocation is really the choice of a life. We cannot divorce what is so important and so central a part of life from what we choose to call the life of the individual. He lives in his shop, factory, or office as well as he lives in his home and club and in his recreation — and the one is vitally related to the other.

Consequently all guidance by whatever adjective modified must be a life guidance. It must take into account the whole life of the individual. It must be humane. It must be educative. It must include in its scope vocational, recreational, social service, and character objectives. It must help each man make himself a better workman, a better citizen, a better neighbor, a better Christian.

The Challenge of Changed Conditions

Archie P. Nevins

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If industrial arts is to remain a vital part of general education in our present machine age, it must continually be kept in a state of flux so that it may be adjusted to the needs of the times, whenever that becomes necessary.

That conditions of modern life are changed from those that formerly obtained is a trite statement. Industrial-arts teachers are aware that some conditions have changed, but they are not always aware of the significance of the change, and in what way it affects their teaching. Even a brief glance at the changing scene will help to give a clue to the course of events.

Such a survey, even though brief, shows one very pronounced trend — the increasing mechanization of life. This is no new discovery, for it has been in progress for many years and has been commented upon by many speakers and writers. Its implications in the field of industrial arts are not so well recognized, although they, too, have been pointed out by thoughtful students of education. The fields of industry, communication, transportation, agriculture, construction, and household equipment, to mention only a few of the more obvious examples, all bear witness to the increasing mechanization of life. Factories, full of automatic machinery, produce goods with a constantly shrinking number of workmen per unit of production. Teletype, automatic phones, robot pilots, power farming, prefabricated houses, mechanical refrigeration, and air conditioning are representative of hundreds of not quite so familiar developments that bear out the fact of increasing mechanization. This is a significant trend and has a great influence on the organization and teaching of industrial arts in the elementary and secondary schools. When the fact of increasing mechanization is coupled with its logical consequence, namely, increased leisure for more and more workers, the change becomes a challenge to adapt our industrial-arts work to the needs of the future as conditioned by these two factors.

Together with the increase in mechanization and in leisure for the worker, we may well take note of some significant conditioning factors which have not changed. Industry still needs, and will continue to need workers with manual skills, ingenuity, and inventiveness, trained in the fundamentals of scientific and mechanical principles. Human individuals still need, and will continue to need, constructive work and occupation. These needs should not be lost sight of in our plans for an industrial-arts curriculum that is to meet the needs of changing conditions.

The reader may ask, "What would be done in such a curriculum that is not already being done?" Perhaps nothing, but anything that is done should be done with the aforementioned factors in mind, not only in the mind of the teacher and supervisor, but the mind of the pupil as well. Shop courses can well take in problems which deal with fundamental scientific principles. Projects in the construction of such things as electric-eye controls, astronomical telescopes, diving helmets, and projects of a similar nature are within the scope of junior- and senior-high-school pupils. Projects of this type have already been adopted by some, but they are not as generally used as they should be. While it is not the function of the industrial-arts course of the junior high school to prepare pupils for entrance into a particular trade or occupation, nevertheless, it can and should teach those principles of science which underlie industrial processes.

That we should continue to develop basic skills in the manipulation of tools and to foster the ideals of craftsmanship, goes almost without saying. Industry will continue to need these skills and ideals in the future as in the past, for as machines become more and more automatic, more and more careful, accurate handwork is needed in their production. While the work of production of goods may have been turned over to automatic machines, the making of these automatic machines of production is in the hands of the machine-building mechanics in a very literal sense. Along with the development of skills and craftsmanship ideals, we must still continue to give the related information regarding industrial processes, raw materials, working conditions and industrial organization, and the way in which it functions in our social and economic system. Perhaps the reader will think that industrial arts goes a long way out of its proper field to try to teach pupils the place of industry in our social and economic system, and the writer admits that there is a very real check operating here in the limited time available for our subject, but he also admits that industrial arts is the proper place to begin the approach of the pupil to these questions which are inseparably bound up with the industrial system. Any course of industrial arts which teaches tool processes only, and fails to mention or point out any of the broader contacts of the subject with the world which surrounds the student, is failing to utilize the subject properly as an effective avenue of education. To meet the challenge of the new conditions, the student must be orientated with the industrial world, and the industrial-arts course is a proper place to give him this orientation.

Visual aids are an invaluable help in bringing the methods and conditions of modern industry into the school shop. *Visual aids* means motion pictures to most teachers, to the exclusion of other effective methods of visual instruction. Motion pictures are valuable, and where they are available, should be used for bringing the factory into the schoolroom, but magazine pictures, advertisements, and articles have a great value in this connection. Clippings and pictures on the shop bulletin board carry much information to pupils in the shortest and most direct line. Some men in industry have the ability to talk to

pupils and get a story across. Where such individuals are found, the shop teacher is overlooking a very good opportunity, if he fails to arrange to have these persons talk to his classes about industrial methods and requirements. Shop visits have been made by many classes in the hope, on the part of the instructor, that they would receive something of benefit to pay for the time, trouble, and effort involved in getting the class there and back in time. Doubtless, there is much to be said for the shop trip where the trip is carefully planned, where the class has discussed what they are to see, and where the essential things are pointed out to them while they are going through the shop, but the trip which just takes the class to a factory and brings it back again without any particular plan or advance discussion, is more apt than not to be just a waste of time and energy. Lack of sufficient time for shop trips is a serious handicap in schools where classes must run on schedule and other departments are jealous of the time allotted to them. The writer has found that the motion picture or the film slide is the answer to this difficulty, because with it the shop trip can be taken without leaving the school, and the things that need emphasis can receive it while inconsequential details can be hastened over.

Along with the needed emphasis on the industrial aspect of the problem, is the other aspect of what to do with increasing leisure. Industrial arts has a very definite contribution to make in this field, that of laying a foundation in the realm of hobbies, and of pointing out some of the possibilities possessed by the hobby as a wise use of leisure. In this connection, the work of the industrial-arts course should not be circumscribed by the limitations of the regular day-school course. Evening-school work with adults in the hobby crafts is a field of legitimate interest and work for the industrial-arts teacher, and with increasing leisure, more and more adults are going to demand such opportunity. Courses which increase proficiency in a present occupation or prepare for entrance into another will also be in greater demand than heretofore.

To meet the challenge of changed and changing conditions of life is a requirement of progress and even of survival for individuals and institutions. The most effective means of meeting this challenge is the practice of the art of thinking, and industrial arts is in the happy position of being an especially effective tool for the development of proficiency in that art. The finding of facts through observation and reading, selection of the facts that apply to the situation at hand, application of the facts to the problem, and testing of the result; all these are routine procedures in industrial-arts work. We need to point out the steps of this technique and show its application to other fields of thought and activity, for although the results secured here are very tangible and objective, the results in less objective fields are no less real, even if intangible. The real purpose of any education is to stimulate and assist people in the solution of their individual and collective problems. Never before has there been more need that the people of this nation and of the world practice the art of thinking, and industrial-arts teaching can best meet the challenge of changing conditions of life by teaching the effective practice of that art.

Related Subjects Material for the Drafting Room

J. K. Olsen
Chicago, Illinois

Important information which designers must know about materials which they specify.

Raw Material Used in the Stamping Industry

In our highly competitive markets, the designs that are using the cheapest and least material for obtaining the same results must have the preference. Since changes and improvements in raw materials are made from day to day, designers must be forever on the lookout for that which will best serve their purposes. It is their responsibility to conserve raw material as much as possible.

A good design made as cheaply as possible is directly or indirectly beneficial to all.

The following description covers the characteristics of the most commonly used raw materials utilized in the production of stamped products, including flat, formed, and drawn parts.

The main factors to be considered in the selection of raw materials are: *Kind, thickness,* and *temper.*

Other factors that need consideration are: Should the material be in the nature of sheet or strip, and if strip, should it be straight strip or coil stock? What should be grain direction, grain size, composition, finish, heat treatment?

Production engineers and designers must know all of these various items about the raw sheet metal which they have to use.

I. Kinds

The most common kinds of raw materials that are used in stampings are undoubtedly, aluminum, brass, bronze, copper, fiber, monel, nickel silver, and steel.

Of these, steel and brass are used to a far greater extent than the others. Steel is the basic material so far as the stamping industries are concerned.

Kind is a broad word which many times is taken to include everything and often misused in connection with materials.

Steel. In selecting the kind of material to be used, steel is probably a first choice where no essential technical reason against its use is involved. Steel is the cheapest material and makes a strong part. It can be obtained in temper and thickness suitable for almost any use and shape. Steel also has the feature that it can be easily heat treated.

The kind of steel that has a wide usage in stamping is *cold-rolled strip steel.* This steel is made by the basic open-hearth method, and when properly made, is a very good material for making stampings, especially where close limit requirements on formed or drawn parts must be maintained. Cold-rolled strip steel is made from hot-rolled strip steel.

The harder grades of cold-rolled strip steel are generally used for such parts as washers, keys, and other flat pieces. The softer kinds are used for drawing parts for automobiles and accessories, airplanes, radios, bicycles, cash registers, adding machines, meters of various kinds, typewriters, sewing machines, telephones, hardware and stove trimmings. It is also used for knives, forks, spoons, hinges, bells, shoe shanks, roller and ice skates, link chains, moldings, and many other products.

For a part that does not have to be held to close limits in forming or bending, hot-rolled strip or sheet steel, because of its greater cheapness, should be considered in preference to cold-rolled steel.

Hot-rolled strip steel cannot be made thinner than .035 in. and then only in narrow widths. If thin, wide strip stock, therefore, is required, it may be cheaper to use a cold-rolled strip. It should, however, be remembered that such additional requirements as pickling, annealing, and oiling are extra. This material is used for parts similar to those listed under cold-rolled strip steel.

Another cheap steel material is the common hot-rolled mild steel. It is generally pur-

chased in the form of bar stock of convenient cross section, and is ordinarily used for forming brackets and other supports.

Common cold-rolled or hot-rolled strip or sheet steel generally has no spring temper and when a steel part is required to function as a spring, a different class of steel is required. There are various commercial names for these spring steel grades, one of which is "hot-rolled sheet spring steel," suitable for numerous manufacturing purposes such as harvesting machinery, knives, scissors, back springs, flat springs, shovels, wearing plates, cutlery, and other parts which need hardening or are subject to excessive wear.

Another kind of spring steel is the hot-rolled bar spring steel which is commonly used for carriage, automobile, railway, and machine springs.

A higher grade of spring steel is the common clock-spring steel which is tempered and polished. It can be obtained in straw or blue colors. This material is extensively used for coil springs and other complicated springs.

Brass. Next to steel, brass is by far the most important raw material used for stamping operations.

There is something about brass that makes a designer, diemaker, or production man feel confident that he will come out of all problems with the minimum amount of trouble.

Brass is what a mechanic would call "a willing material." Besides this, brass ranks well with later high-grade stamping metals, so far as appearance goes. There is still something attractive about the old shiny brass fixtures and parts that were used in and on old conveyances, ships, and houses. It is undoubtedly the work that is required to keep this metal in a polished condition that has eliminated its preference.

The kind of brass that is mostly used today is the commercial "high sheet brass." It is quite yellow in color, ductile, easily worked and will take a wide variety of tempers by cold rolling or drawing. The softer kinds are obtained by the annealing process.

Brass will not rust, but it is subject to some corrosion when exposed to the elements.

Brass is more expensive than steel, but it has other features which are in its favor. For example, where a brass and steel part are adjacent to each other, there is no chance of the parts rusting together. In electrical work, brass may have to be used because brass, while good as an electrical conductor, does not become magnetized.

Another feature in using brass, is that it can be used directly as a base for most high-grade plating, whereas steel must be plated with some base plate, such as copper, in order to take the final nickel or chrome plating.

Where a high-grade polish is required as in reflectors, brass is preferable because it has a finer grain construction than steel or most other materials.

Brass is one of the most important alloys known and its uses are innumerable.

Phosphor Bronze. Phosphor-bronze strip is mostly used for high-grade springs. It is excellent for this purpose because it possesses strength and long life. Phosphor bronze may be considered a higher grade of brass. It is, of course, more expensive than brass. It is used both for mechanical and electrical parts and will in many cases function where brass fails.

Aluminum. In most products, the weight is an important factor and in some designs where lightness is a requirement, aluminum is frequently used as it weighs less than any other commonly used material.

Aluminum alloys are divided into two main classes, those which cannot and those which can be hardened by heat treating.

In the first class, simple alloying and strain-hardening by cold work constitute the only means of increasing the strength and hardness. In the second class, the increase in tensile strength and hardness is accomplished by a solution heat treatment or a solution heat treatment followed by aging.

Sheet aluminum can be obtained in a series of codes and the most common alloy used for sheets is the kind designated as 17S for strong aluminum; alloys 2S and 3S are the most commonly used for deep stamping and difficult bending. Grade 2S is practically pure aluminum.

Aluminum, because of its strength and light weight, is used largely in the airplane industry. Another valuable aluminum alloy is duralumin, which is practically as strong as mild steel, and therefore finds many uses.

Miscellaneous Materials. There are several nonmetallic materials which constitute an important item in the raw material stock used in the stamping industry. One of these is fiber sheet, which is used extensively for insulating purposes and which may be given a slight form and bend. Other gasket materials, are manila paper, cork, and various types of composition materials.

A later material that has also been adopted to a considerable extent for parts which require more strength than fiber is what is commercially known as laminated linen and laminated canvas.

There are many other types of materials used in the stamping industry, but they are more or less special.

II. Thickness

The thickness of material depends in most cases on the design, and it is, of course, very important that this factor is considered with utmost care as both the cost and weight of the part are proportional to the thickness.

The gauges most frequently used in the stamping industry, are the Birmingham and U. S. gauge for steel, and the American or B & S gauge for brass and other nonferrous materials.

It is regrettable that there are so many different kinds of gauges in use at present, and it is hoped that some day all sheet and strip material will be made to the same gauge. As it is, the gauge question leads to much confusion.

The designer especially must be careful when he is using a variety of materials on a product because the different materials may be manufactured according to different gauges. Furthermore, changing from one material to another, for instance, from brass to steel, may frequently require the reworking of the dies used to produce the part.

To add to the confusion, the various materials also have different thickness limits.

The gauges used with different materials are indicated in the following table.

Material	*Sheet Gauge*
Aluminum	B. & S.
Brass	B. & S.
Bronze	B. & S.
Copper	B. & S., B.W.G. or Weight
Fiber	Fractions
Monel	U. S.
Steel, H.R. sheet	U. S.
Steel, C.R. strip	B.W.G.
Steel, H.R. strip	B.W.G.

If production demands it, thicknesses which deviate from the standard gauge sizes may be specified. Of course, this will add to the cost. In order to decrease the number of thicknesses carried in stock by the manufacturers of raw material, it would be desirable if all designers would favor the even gauge numbers.

It also would be desirable if all sheet gauges were replaced by one gauge, for instance, the U. S. standard gauge.

Cold-rolled and hot-rolled strip steel are probably used more than any other type of material for stampings. Cold-rolled strip steel can be obtained in almost any thickness. Hot-rolled strip steel, however, is not generally made below .035 in. in thickness.

In specifying the thickness of material, mistakes may be avoided if the thickness is specified decimally only. This practice will make both the gauge name and gauge number superfluous.

Cold-rolled steel comes closer to the decimal thickness to which it was rolled than does the hot-rolled steel. Brass and phosphor bronze come slightly closer in this respect than does cold-rolled steel. Other material, like spring steel, also can be expected to come closer than the regular cold-rolled steel.

Aluminum tolerances are approximately the same as for sheet brass.

It is important, of course, that the designer in selecting raw material for parts with close limits, should select material which varies least in thickness. This is especially true with regard to cold-rolled and hot-rolled strip steel, as the dies have to be made to take care of the variations.

III. Temper

Most materials have tempers which vary from dead soft to spring temper. However, there is a considerable difference, for example, in ferrous and nonferrous materials, and this must be considered in each case.

It is understood, of course, that the softer materials are always used for the more extensive forming and drawing operations, and that the harder kinds are chosen for strong and flat parts.

The methods of obtaining hard tempers in steel and in nonferrous material such as brass are quite different.

Brass is hardened by reduction in thickness

(Continued on page 124)

INDUSTRIAL ARTS *and* VOCATIONAL EDUCATION

J. J. Metz, Editor

Developing Proper Attitudes

In the early days of the manual-training era, there were many shop teachers who felt that the work offered in their shops automatically developed attitudes of honesty, fairness, orderly procedure, and the like. That this does not necessarily follow has been recognized for a long while, yet in most cases, little has been done to take care of helping the student develop the attitudes so necessary to him as a member of society.

It is usually conceded that the shop teacher comes into closer contact with his students than do the teachers of most other subjects. He, therefore, may be looked upon as a key man in producing desirable results in the pupil. The building-up of proper attitudes, then, not only comes within the scope of the shop teacher's work but may even be looked upon as being, if not the major duty, nevertheless, an important part of each shop teacher's function. This is especially true regarding those attitudes which the student should develop with respect to his future lifework and the human relationships which this will bring about.

The shop teacher must not forget that he is dealing with the raw material out of which our future society with its great men, average men, mediocre men, its undesirable and dangerous characters, will be constituted. Considering this in all of its ramifications will at once show how extremely necessary it is that each teacher should carefully consider and study the importance of his contribution in this gigantic undertaking of educating the youth of our country. It will also show the necessity of choosing only the best type of men and women for the important task for preparing our future Americans — men who have strong convictions — yes, but men who think through each problem with an unbiased mind. Men whose thinking is not warped by selfishness, men to whom the good of the many is paramount, who do not seek personal advantage or preferment at the expense of others. Men who are ready and willing to shoulder responsibility, but who do not seek dominance for selfish or ignoble purposes. Men who themselves live lives which the student may take as models on which to build his own. Lives that are founded on a philosophy that is worthy of man. Lives that do not run to excesses in any direction. Lives in which morality plays an important part at all times and under all conditions.

Given such a teacher, what are the attitudes which he ought to strive to establish in the students who attend his classes? It seems hardly necessary to enumerate them, and yet it frequently happens that one gets a new vision by reviewing and reorganizing facts which one has long known.

Probably, for the shopman, it is best to stress desirable attitudes in connection with the immediate work confronting the student in the school shop, yet with conscious recognition of these attitudes in the student's life after he has entered the workaday world. Again, it is well to recognize at the outset that the future professional men, financiers, business men, inventors, manufacturers, agricultural leaders, together with their workmen, foremen, superintendents, and executives, are in school right now, and that while attitudes such as honesty, fair play, and the like, ought to be part of every man's make-up, yet the method of application may differ according to the position which the individual occupies in life. This very fact has to be borne in mind and the specific applications pointed out if real results are to be obtained. That is why the teacher must be so well posted and so broad-minded. That is why he cannot lean over to one side or to the other in his discussions of employer-labor questions. Both have rights but both have obligations, too, and the teacher of today is confronted with the training of the employer and the employee of tomorrow. The problems which will confront the student in his future situations, be they as employer or as worker, must be previewed by the teacher, and this can be done only by a fair-minded person with a broad outlook.

The few attitudes mentioned in that which follows can by no means be looked upon as an exhaustive list, and no attempt has been made to arrange them as to importance, yet it may be helpful to some who, up to now, have failed to look at the development of proper attitudes as a part of their professional duty.

To start then, it may be just as well to let *recognition of, and obedience to authority* head the list of the desirable attitudes to be gained. Of course, the student may have partially developed this attitude from his previous experiences at home, on the playground, and at school. It must be impressed upon him, however, that his future success will depend largely upon his thorough acceptance of the idea that the welfare of the individual, of the family, of society at large, depends upon the acceptance of the idea that authority is recognized and accepted. It will be necessary plainly to indicate to the adolescent that recognizing and obeying authority should not be looked upon as something abasing. Reference to the need of strictly adhering to directions in athletic games will show the need of recognizing and obeying authority to most students. Further examples for the need of this attitude may be drawn from civic and industrial cases.

Closely allied to recognition and obedience to authority, yet separate and distinct as an attitude which is to be fostered, is *co-operation.* It is the subordination of one's own efforts to the furtherance of a project which requires united effort to succeed. Again, the need for co-operation in athletic games may be used to illustrate the need for it in actual life situations. Then, too, the interdependence of the individual with the other members of his family, of the members of his team, of his schoolmates, of the members in his community, and even of the people in the state, in the nation, and in the world, may be used to show the need of developing a co-operative spirit.

The interplay of personalities on the playground, in the shop, and in the classroom, will furnish good examples which may be used to show the need for acquiring the *fair-play* attitude. Many examples may be drawn from everyday occurrences which show both the need and the worth-whileness of practicing that best of all fair-play formulas — the golden rule. Were this better developed, no troublesome questions would ever have arisen as to hours of labor, a fair living wage, sabotage, violence against persons, and senseless wrecking of buildings and equipment in labor disputes, for if both employer and employee had always acted fairly neither

would have developed attitudes of suspicion and hatred, nor would they have to bemoan unpardonable acts of violence, losses of time and money, and suffering and mental anguish.

Many other attitudes might be listed, but the student who has made recognition of, and obedience to, authority, co-operation, and fair play his watchword, can hardly have escaped developing attitudes of respectfulness, unselfishness, honesty, and of justice. A thorough understanding of the three first mentioned, will also show him the need for diligence and stick-to-itiveness at his work. These are part and parcel of the attitudes already named. Yet, it will be well if they, too, are individually emphasized and consciously exemplified.

There is need, however, to plan specially for the developing of the student's attitude of *orderliness*. It will be necessary too, to show how his attitude needs to be applied in the home, at school, in one's place of work, and in other phases of one's life. The student also must be led in his acquirement of *self-control*. The need for it can be shown in the boy's contacts at home, on the playground, in the school shop, and in his later contacts in society, at his clubs, in his church affiliations, with his fellow workers, superiors, customers, and the like.

Closely connected with the development of self-control is necessarily the conscious development of will power. This training of the will is necessary for the well-being of every man. It is very difficult purposefully to determine to do things that are repugnant, no matter how necessary the doing of them may be. Only those equipped with will power can overcome natural inclinations. Yet, throughout life the individual will be confronted with situations that will require this exercise of the will. Then, there are bad habits that may have been formed, or good habits that are to be acquired. The accomplishment of either of these two objectives, requires will power, the development of which ought to be, and is a necessary part of the shop teacher's function.

As already stated, the idea that the development of attitudes is a part of the shop teacher's duties is not new. Not much along this line has been accomplished, however. There are many teachers who have never made it a phase of their work. There are others who have made some attempts. The need for it is great, however. One need only study present-day conditions to verify this. The addition of this necessary piece of work to an already overloaded outline of instruction is a large assignment, but not so large that the teachers of industrial arts and vocational education cannot successfully accomplish it.

Allesandro Volta

The student of electricity will be specially interested in the biography of this pioneer of electrical science. He was born at Como, Italy, on February 18, 1745. His parents were not well to do, hence his education was provided for by some ecclesiastical relatives. Correspondence carried on between him and Abbe Nollet, professor of experimental physics, showed that Volta was already giving evidence of his scientific inclination at the age of nineteen. At twenty-four, he published his first paper on electricity, and the publicity which it obtained for him secured his appointment as professor of physics at the Liceo of Como in 1774. He held this position until 1779 when he was chosen to occupy the chair of natural philosophy in the University of Pavia.

His travels through Switzerland, France, Germany, Holland, and England brought him in contact with most of the scientific celebrities of his day. His thorough method and painstaking study helped to solve many of the questions concerning electricity which confronted the scientists of his day.

The twitching setup in frogs' legs by an electrical stimulus was explained as animal magnetism by Galvani in 1786. Volta, however, disproved this contention, and with a condensing electroscope which he invented, demonstrated that his "contact theory" was the real reason for the convulsive movements. It was by means of this electroscope that he proved that after a piece of copper has been touched with a piece of zinc, an infinitesimal charge of positive electricity will be found in the zinc, and an equal negative charge in the copper. He also devised the first practical electrophorus, and even proposed that with it signals could be transmitted over a line to be built between Como and Milan.

In 1790 he invented the voltaic pile, consisting of pairs of disks of copper and zinc, the pairs being separated by disks of cloth wet with salt water or with a weak acid solution. A description of this invention was sent by Volta to the president of the Royal Society of London on March 20, 1800. He himself improved the efficiency of the voltaic pile when he devised what he called the "crown of cups" in which connected copper and zinc strips were placed in cups of salt water or dilute acid.

Many of the scientific societies of the various countries of Europe conferred honors upon Volta. In 1819 he returned to Como, where he died on March 5, 1827. In 1899, an exposition was held at Como to commemorate the hundredth anniversary of the voltaic cell. Many of the instruments made by Volta himself had been gathered for the occasion. Unfortunately, a fire ensued and many of these priceless historic pieces were lost to posterity.

In recognition of the contribution made to the science of electricity by Alessandro Volta, the practical unit of electrical pressure has been named the volt. In this way the name of this pioneer of electrical science will be kept continuously before those who study, work with, and use electricity.

Industrial Arts, General Education, and Vocational Education

The address entitled "Industrial Arts, a Vital Service," given at the American Vocational Association Convention at San Antonio, by Dr. Homer J. Smith, Professor Industrial Arts, University of Minnesota, and which was subsequently published in the February, 1937, *AVA Journal and News Bulletin*, ought to be read by every shop instructor, as it touches upon many points which he ought to know.

Not only does Dr. Smith show the relationship which exists between industrial arts and general education, but also that which ties together industrial arts and vocational education. Some of the particular contributions made by the industrial arts, as he points out, are commonly accepted, yet they bear repetition. Thus, for instance, the industrial arts aid in self-expression; develop creative powers; intensify the urge to plan and construct useful articles; provide acquaintance with materials, processes, and conditions found in the immediate environment and in the realms of industry; develop resourcefulness, perseverance, pride of craftsmanship; help the student in the acquisition of social intelligence, and in obtaining a true conception of the dignity of work.

Industrial arts provide manipulative experiences which appeal to the student, and thus are admirable for giving opportunities for exploration and for preliminary preparation for future specific training toward either industrial or professional careers. The future possibilities of growth of the industrial arts as schoolshop subjects are mentioned, and the steps outlined which shop instructors must take if they wish to give their subject the position it deserves in the school curriculum of our country.

RELATED SUBJECTS MATERIAL FOR THE DRAFTING ROOM

(Continued from page 121)

in the following process by two B. & S. gauge thicknesses per temper, whereas the steel is hardened by heat treatment. Both steel and brass have to be annealed to obtain the soft tempers.

In certain cases the strains in formed or drawn steel and brass parts must be removed by annealing.

Steel. In general there are three types of steel. *Low carbon steels,* .08 to .15 carbon, are used mostly for deep stamping in cold-rolled sheet. *Mild steels,* .15 to .30 carbon, are used mostly in brackets, supports and bar stock. *Spring steel,* .50 to 1.05 carbon, are used mostly in springs of all kinds. The steel may be either hot rolled or cold rolled.

Cold-rolled strip or sheet steel is made in five tempers, namely, hard, medium hard, medium soft, soft, soft-skin rolled or pinched temper, dead soft.

Commercially, the temper known as hard is often called full hard, medium hard is also known as half hard, medium soft as quarter hard, soft-skin rolled as skin-rolled, and dead soft as soft.

In this description of temper, it should be noted that the temper "soft-skin rolled" is produced from the dead soft material by giving the latter one additional rolling operation, which reduces the thickness approximately .0005 to .001 in. and produces a somewhat harder and smoother surface. Steel thus treated will permit the more complicated deep draws and rounded corners to be made without producing strains or an alligator-skin surface. The soft-skin rolled steel also is preferred for polished, plated, and enameled parts. The price of the skin-rolled temper should in most cases be the same as for the dead soft.

In parts which have to be made with a series of draws, the material has a tendency to crystallize. This produces strains which may cause cracks or splits. To obviate this, it is necessary to anneal the stock between draws even for dead-soft steel as well as for brass and other similar materials.

Each one of the five tempers described in the foregoing is for a different purpose. Each must be selected with its particular characteristics in mind. Thus, hard or full hard is a stiff and springy steel. It should not be required to make bends in either way of the grain. It is intended for flat work only.

Medium hard or half hard is a material with considerable stiffness, but it must be able to take a sharp right-angle bend across the grain without cracking. It is suitable for easy cold-working operations such as very slight drawing, cupping, or forming. This material therefore, can be used for making many ordinary parts.

Medium-soft or *quarter-hard* material must be able to stand bending down upon itself across the grain and should be able to stand being bent 180 deg. with the grain over a radius equal to the thickness of the stock without fracture. This temper, however, is used to a lesser extent than the two previously mentioned tempers.

Dead soft-skin rolled is, as before described, of the same temper as dead soft and should meet the same requirements. As a matter of fact, this temper should in most cases be preferred to the plain dead soft.

Dead soft is the commercial extra deep drawing temper and suitable for difficult bending work. It should stand being bent flat upon itself both with and against the grain without any indication of cracking. To avoid wrinkling in shipping and handling, it is in some cases necessary to order material with this temper in straight lengths.

Smaller firms will do well to concentrate on less than five tempers, for example, the greatest number of parts can be made from hard, medium hard, and skin-rolled tempers. It may even be advisable to confine the tempers to only two, namely: dead soft-skin rolled, and medium hard.

Another series of strip and sheet steel is the hot-rolled tempers.

One of the most common hot-rolled steels is the hot-rolled pickled and oiled, low carbon steel. This material can be purchased suitable for moderate drawing, embossing, and right-angle bending work. This same material with a higher carbon content sometimes called rigid hot-rolled steel can be purchased suitable for flat punch-press work and for parts where stiffness and long wear are important.

Another temper of hot-rolled steel, is the hot-rolled annealed pickled and oiled steel. This is suitable for deep drawing, difficult forming, and stamping.

The hot-rolled steel can also be obtained in dead soft deep drawing pickled box annealed and oiled steel and is suitable for extra deep drawing and any difficult bending work.

From the foregoing, it may be seen that the hot-rolled strip and sheet steel is more suitable for some jobs than cold-rolled steel would be.

Mild Bar Steel. Bar stock also is used for making stampings. One of the most common kinds used for stamping purposes is the commercial hot-rolled mild steel bar made from low carbon steel. The temper is generally that resulting from the rolling process. This steel bar stock has many commercial uses especially with various forming operations.

Tempered Spring Steel. Articles which require simple bends and forming also can be made out of medium carbon black tempered spring steel.

There also are many different alloy steels in use such as chrome or nickel alloys. These may be obtained in the same temper range given to cold-rolled strip or sheets. It should always be remembered that the steels proper can be made harder by heat treatment and can be made softer by annealing.

Coated Steels. There also are various coated steels such as tin plate and terne plate, and the temper for this type of material is generally specified on the order, for example: The material must single seam without wrinkling or cracking, or the material must possess moderately deep drawing qualities, or the material must possess deep drawing qualities.

(To be continued)

Glossary of Printers' Terms—I

R. Randolph Karch
Arsenal Junior High School,
Pittsburgh, Pennsylvania

This list of words will be welcomed by many instructors of printing.

Adman. A compositor who sets advertisements.
Agate. 5½-point body type.
Air Conditioning. Process used to keep paper from shrinking and stretching.
Alive. Type, after it has been set, before it is ready for distribution.
Allegro. A kind of type face.
Alley. Floor space between two type cabinets.
Aluminotype. A plate made from an aluminum alloy.
Antimony. One of the ingredients of type metal.
Antique. A rough-surfaced paper.
Antique Roman. A style of type.
Apprentice. A learner of a trade.
Arabic Numerals. 1 2 3 4 5 6 7 8 9 0.
Autopress. A high-speed cylinder press.

Backing-Up. Printing the other side of a sheet.
Balance. A pleasing arrangement of type masses.
Bank. A stand to hold type and spacing materials, with working space.
Basis Weight. The name given to a sheet of paper in terms of the weight of a ream (or 1,000 sheets) in a certain size.
Beard. The beveled space below the face of a type.
Bearers. Type-high ledges on a press to insure the rollers turning; strips of wood or metal placed inside the ends of platen-press chases.
Bed. The part of a press on which the form is placed.
Ben Day Process. A mechanical method of producing a shaded effect on a line plate.
Beton. A kind of type face.
Beveled Rule. Rule on which the printing surface is on one side.
Bill of Fare. A menu.

Binder. A temporary cover. One who does bindery work.
Bindery. A place where books are assembled and bound.
Black Letter. A style of type, bold text or Gothic.
Blank Case. A type case minus the partitions.
Block. A hardwood or metal base for plates. A woodcut.
Block Letter. Gothic or sans-serif.
Bodoni. A type family.
Body. The size of type from the bottom to the top of the letter.
Body Type. Type used for straight composition.
Bond. A strong and translucent rag or sulphite paper.
Book Paper. A class of paper used for making books.
Borders. Characters cast in type or in strips used for panels, etc.
Braces. Characters used to group type matter (⏜).
Bracket. Characters used to enclose words, figures, etc., from the text [ ].
Brasses. Brass leads used in newspaper make-up.
Brass Rule. Strips of brass to print lines.
Brass Spaces. Spaces about 1-point thick.
Brayer. An ink roller used for proofing.
Brilliant. A small size of type, now 4 point.
Bristol Board. A fine grade of cardboard.
Broadside. A specially folded advertising sheet.
Brochure. A small booklet.
Bronze Powder. A fine powder to give brilliant glossy effects in gold, silver, etc.
Bronzing. Brushing a fine bronze powder, which adheres to the print, over a freshly printed sheet.
Bundling Machine. A machine used for compressing signatures, padding, etc.
Butted. Slugs placed end to end to form one line.

Cabinet. An enclosed chest to hold type cases.
Cairo. A kind of type face.
Calender. A papermaking-machine device which gives the high gloss to papers.
California Job Case. A type-storage case.
Camera. A kind of type face.
Canon. An old size of type, now 48 point.
Cap. Capital letters. A 14 x 17-in. sheet of paper.
Caption. A heading or title.
Car Card. A large card bearing an advertisement, used in cars and busses.
Cardboard. A thick, stiff paper.
Cartoon. A kind of type face.
Case. A shallow tray divided into compartments, used to hold types.
Casein. An albuminous substance used for sizing paper.
Case Stand. A framework used to hold type cases.
Caslon. An old-style roman type, originated by William Caslon.
Cast. To pour metal into a mold.
Caxton Black. A black gothic type face.
Cellulose. A fibrous substance used to make paper, obtained from cotton, linen, hemp, and wood.
Centaur. A kind of type face.
Centered. Placed in the center of a sheet, of line.
Century. A type face.
Chalk Overlay. An overlay mechanically made in making ready type forms and plate forms on the press.
Chalk-Plate Engraving. A process of making illustrations by engraving the design on a chalk-covered steel plate, and casting as in stereotyping.
Chapel. An organization or workmen in a printing office.
Chase. An iron or steel frame in which type forms are locked for the press.
Cheltenham. A name of a family of type faces.
Chroma. The degree of intensity from black to white in color.
Circulars. Advertising matter in the form of letters and handbills.
City Compact. A kind of type face.
Clarendon. A style of type.
Clay-Finish Paper. A paper in which fine clay is used to smooth the surface.
Clean Proof. A term used when few errors are found on a proof.
Cloister. A type face.
Closed Shop. A shop in which only union workmen are employed.
Coated Paper. A smooth and glossy finished paper.
Collating. Examining the folded signatures of a book in the process of gathering to see that all sections are in order.
Colophon. An inscription in a book telling of the printing thereof.
Color Filter. A sheet of colored glass used in photographing for color plates.
Color Form. The form making the second color in a job of printing.
Colt's Armory Press. A platen press built on the Universal pattern.
Column. A vertical series of lines side by side, as in newspaper composition.
Column Rules. Strips of rule used between columns in newspaper and magazine composition.
Combination Halftone. A printing plate made up of the halftone and line-etching processes.
Composing Machines. Machines producing single types and regular composition mechanically.
Composition. Typesetting and arranging types.
Compositor. One who sets type.
Condensed. Thin type faces.
Copperplate Engraving. The practice of making impressions from intaglio plates.
Copperplate Gothic. A series of type faces made in the sans-serif style.
Copper Spaces. Spaces ½ point thick.
Copy. That which the printer copies in his work.
Copy Cutter. One who divides copy into pieces of small size which are given to compositors in newspaper shops.
Copyholder. One who holds copy and reads aloud therefrom to the proofreader.
Copyreader. Same as copyholder.
Cover Papers. Heavy, decorative papers used for covering pamphlets, etc.
Creasing. Bending sheets of paper to make them fold and lie flat.
Crop. To cut down printing plates.
Cut. An angraving, electrotype or stereotype.
Cut Cards. Cardboard cut to standard sizes.
Cut-Off Rule. A rule used to separate advertisements in newspaper make-up.
Cutting Rule. Steel rule used to cut out designs on a printing press.
Cylinder Press. Style of printing machine which prints by the action of a cylinder on a flat form.

Dandy Roller. A wire cylinder on a papermaking machine that makes the wove or laid effect of the paper; also the watermark.
Dashes. Straight lines in en and em widths, cast in sizes from 5 to 24 point.
Dead. Type ready for distribution.
Dead Line. Last day or hour in which copy is acceptable.
Deckle Edge. An untrimmed featheredge.
Depth Gauge. Device for measuring depth of relief printing plates.
Devil. The youngest apprentice in a printing office.
Diamond. 4½-point type.
Diane. A kind of type face.
Die Stamping. Intaglio printing done by means of a die and counter die.
Diphthong. Two vowels joined together, as æ, œ, etc.
Dirty Proof. A proof containing many errors.
Disk Ruling Machine. A machine for ruling lines with disks rather than steel pens.
Disk. The flat circular plate on a platen press upon which the ink is distributed.
Display. Composition in which various sizes of types are used.
Display Type. The larger and heavier faces of type.
Distribution. The placing of type and spacing material back into the cases.
Drier. A substance added to ink to assist in drying.
Drum Cylinder Press. A printing machine with an extra large cylinder, which carries the paper to the impression.
Dull-Finish Paper. Coated stock with glossy finish removed.
Dummy. Pages of a planned book put together to assist in determining the specifications, etc.; the "layout" of a book or pamphlet.
Dump. The place where dead matter is stored.
Duplex Press. A printing machine which prints both sides of the paper in one passage through the press.

Egmont. A kind of type face.
Electrotype. A duplicate of a type form or plate.
Elzevir Old Style. A style of type face.
Em. The square of the type body of any size; the unit for measuring printing material by 12-point ems.
Embossing. Impressing letters and figures in relief.
En. One half the width of the em.
Enameled Paper. Paper coated with clay, glue, and other substances, having a glossy finish.
Engraving. The process of cutting letters and designs into a plate for the purpose of making impressions.

Envelope Corner Card. The printed address in the upper left-hand corner of envelopes.
Erbar. A kind of type face.
Esparto. A papermaking fiber made from a grass.
Etching. A method of making printing plates by the action of acid on the plate.
Expanded. A very thick type face.
Extra Condensed. A very thin type face.

Face. The part of the type that makes the impression.
Family. A group of related type faces in a series of sizes.
Fan Out. To separate sheets by gently rubbing them to form a fan-shaped pile.
Farm Out. To sublet a job of printing.
Feeder. A person who hand-feeds a press. An automatic-press sheet feeder.
Feed Guides. Appliances used for holding sheets in position while printing.
Feet. The two lower projections of a piece of type.
Fender. A strip of cardboard used to hold sheets on a press.
Flash-Dry Inks. Ink that dries immediately by oxidation.
Flat Bed. Said of a press printing from a flat form or plate.
Flex. A kind of type face.
Flong. A matrix used in stereotyping.
Flush. To the end of either side, or end of a line, as "set flush right" in type composition.
Fold. Doubling over a sheet of paper.
Folio. A sheet folded once, consisting of two leaves forming four pages.
Font. An assortment of any one size and style of type.
Forwarding. The process of binding a book after the sheets are fastened together.
Fourdrinier. A papermaking machine.
Franklin Gothic. A kind of type face.
Furniture. Pieces of wood and metal to fill large blank spaces in printing forms.

Galley. A shallow tray in which type is placed for assembling or storage.
Galley Press. A proofing machine.
Garamond. A style of type face.
Gathering. Collecting signatures of a book.
Gauge. A piece of metal used to hold sheets in a press in the correct position for printing.
Golding Jobber. A platen press.
Gordon Press. A style of platen press.
Goss Press. A perfecting printing press.
Grain. The direction in which the fibers lie in a sheet of paper.
Grippers. Iron fingers on a platen press to hold the sheets to the platen.
Gudgeons. Metal wheels used on press roller stocks.
Guide. Feed gauges against which the sheets are fed in the printing presses.
Gutter. The back margin of a book sheet.

Hair Line. The fine and delicate lines in a type or engraving.
Hair Spaces. Very thin spaces used in typesetting.
Half-Diamond Indention. When successive lines are indented each slightly more than the other in straight composition.
Half Title. The title place at the head of the first chapter of a book.
Halftone. A printing plate made by the photographic and chemical processes, in which the picture is made up of a series of very small dots.
Handbill. A small printed advertisement.
Harmony. The state of a pleasing relation between parts of a piece of printing.
Harris Press. An offset printing machine.
Head. The top of a book; the title of a newspaper article.
Hell Box. A receptacle in which broken type and materials are placed.
Highlights. The lightest parts of a printing plate.
Hoe Press. The trade name for cylinder presses.
Hot Embossing. The process of embossing with the use of heated dies.
Hydro Inks. Bright, dull-setting printing inks.
Hypotenuse Oblong. A page proportion in which the depth is 50 per cent more than its width.

Imitation Embossing. Thermography.
Imposing Table. The flat stone or metal-topped table on which forms are locked for the press.
Imposition. The proper placing of page forms in a chase.
Impression. The pressure of type forms or plates on a piece of paper.
Impression Screws. The adjusting screws that regulate the position of the platen on a platen press.
Indent. To space before a line in type composition.
Inferior Figures or Letters. Small figures or letters cast on the lower part of a type, thus, $_{1\,2\,3}$ or $_{a\,b\,c}$.
Initial Letter. The larger letter beginning a piece of straight composition.
Ink Fountain. A device to feed small quantities of ink to printing rollers on a press.
Insert. An extra sheet placed in a book.
Intaglio. Engraving cut into either wood or metal.
Intertype. A slug-casting composing machine, similar to the linotype.
Italic. Slanting types.

Jenson. A type face; also the name of a famous Venetian printer.
Jobber. A press for small work.
Job Compositor. A typesetter who sets commercial work.
Job Font. A small assortment of type in any one size and style.
Job Galley. A small tray used in job composition.
Job Printer. A printer doing small commercial printing.
Job Ticket. Usually an envelope containing copy, on which directions concerning the job are given.
Job Type. Type faces used in printing small commercial work.
Jog. To straighten sheets of paper.
Journeyman. A printer who has finished his apprenticeship.
Kaufmann. A style of type face.
Kelly Press. An automatically fed cylinder printing machine.
Kennerley. A style of type face.
Kern. The part of the face of a type that extends over the body.
Key. A device used in operating quoins.
Key Plate. The plate used as a guide to register other plates in color printing.
Kidder Press. A style of printing press, usually rotary machines.
Knee. The movable piece on a composing stick.
Kluge. An automatically fed platen printing press.
Klymax Feeder. A style of sheet feeder attachable to a platen press.
Kraft Paper. A tough wrapping paper.

Labor Saving. Any printing material cut to small, assorted lengths.
Laid Paper. Paper having parallel lines watermarked at equal distances apart.
Laureate Press. A platen press with a perpendicular, rigid bed.
Lay of the Case. The arrangement of the letters in a type case.
Layout. The plan of a job of printing.
Layout Paper. Paper used in laying out, having pica squares ruled upon it as guides.
Lead Cutter. A device to cut leads to small sizes.
Leaders. Periods or dots at intervals to lead the eye in tabular matter, etc.
Leads. Thin strips of metal used to space between lines of type.
Letterhead. A printed heading on letter paper.
Letterpress. Printing from raised letters, as from type.
Letter Spacing. Spacing between letters in type composition.
Liberty Press. A style of platen press.
Lift. After a form is locked up, and each piece of type is held securely, it is said to "lift."
Ligature. Two or more letters tied together and cast in one piece of type, as fi, ff, fl, ffi, ffl.
Light Face. A term used for a face of type of lighter form than usual.
Line Cut. See line engraving.
Line Engraving. A printing plate made up of black and white; a zinc etching.
Line Gauge. See pica rule.
Linen Finish. A paper or cardboard having a finish similar to that of linen cloth.
Lining. The aligning of type faces at the bottom of the letters.
Linograph. A machine that casts slug lines, similar to the linotype and intertype.
Linotype. A slug-casting machine.
Lithography. The process of printing from a stone or plate.
Live. A printing form still in use.
Logotype. Several letters or a whole word cast on one body, as the, and, etc.
Long Primer. An old name for 10 point.
Lower Case. Small letters.
Ludlow Typograph. A slug-casting machine in which the matrices are set by hand.
Luxor. A kind of type face.

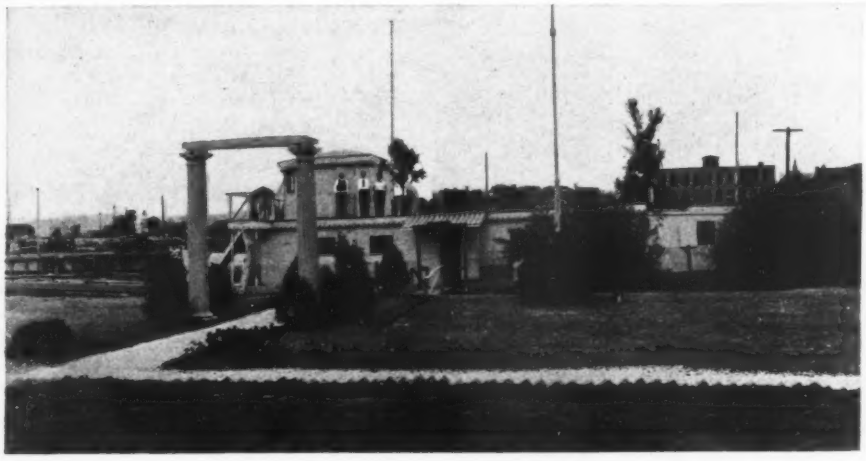
Machine Composition. Any type composition done mechanically.

Machine Finish. A smooth paper used in printing books.
Makeready. Preparing a press to print from the form in the best way.
Making Up. Arranging types and materials into a form.
Make-Up Rule. A flat piece of steel helpful in making up.
Margin. The space between the edge of the paper and the print.
Matrix. A mold in which a type is cast; the paper mold used in stereotyping.
Memphis. A kind of type face.
Miehle Press. A flat-bed two-revolution cylinder press.
Miehle Vertical. A cylinder press in which the cylinder moves vertically.
Miller Feeder. A feeding attachment made for use on platen presses.
Miller. A high-speed two-revolution cylinder press.
Misprint. A typographical error.
Miterer. A device for mitering border; both hand and power.
Modern Roman. A style of type face.
Mold. The part of a type-casting machine in which the type or line is cast.
Mondial. A kind of type face.
Monotype. A composing machine which casts individual types similar to foundry types.
Mortise. The cut-out portion of an electro or engraving in which type is set.
Multicolor Press. A press in which all colors are printed in one time through the machine.
Mutton Quad. An em quad.

Neck. The part of a type between the shoulder and the face.
News Cases. A pair of type cases in which the capitals are kept in the upper case, and the small letters are kept in the lower case.
Newsprint. A paper made from wood pulp.
News Stick. A composing stick with a fixed measure.
New York Job Case. A type case with boxes for capitals, lower case, and small capitals.
Nick. A notch in a type which acts as a guide for the typesetter.
Nonpareil. The equivalent of 6 points; a size of type now called 6 point.
Numbering Machine. A type-high printing machine which is locked in regular type forms, and prints numbers in consecutive order.
Nut Quad. An en quad.

Offenbach. A kind of type face.
Offset Printing. A lithographic process in which the plate prints on a rubber cylinder, which in turn offsets the print to the paper.
Old English. A style of black-faced text type.
Oldstyle. A type style with diagonally sloping serifs.
Onionskin. A thin paper.

(To be continued)



The sea-scout base on June 6, 1936

Building a Sea-Scout Base

Orville Hayford

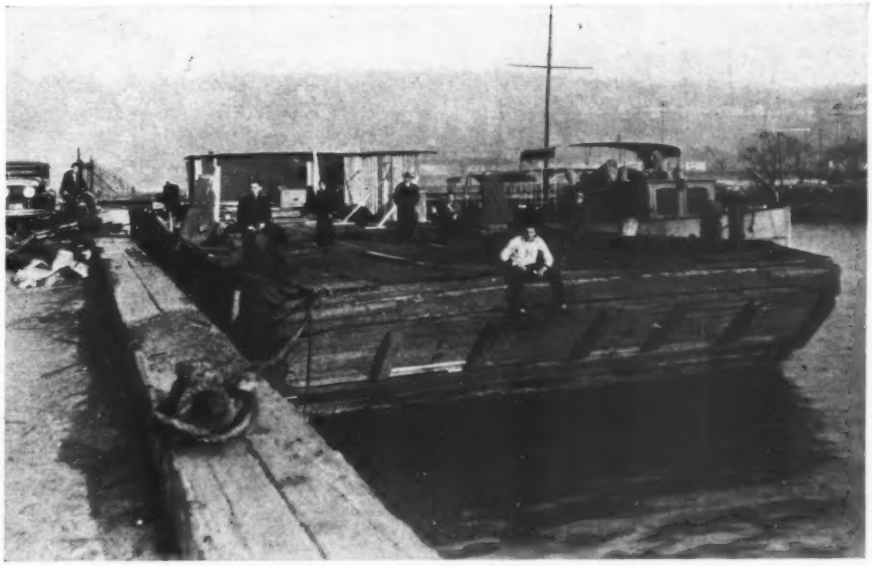
High School,
Tarrytown, New York

A worth-while job, planned and carried through by the industrial-arts department of a high school.

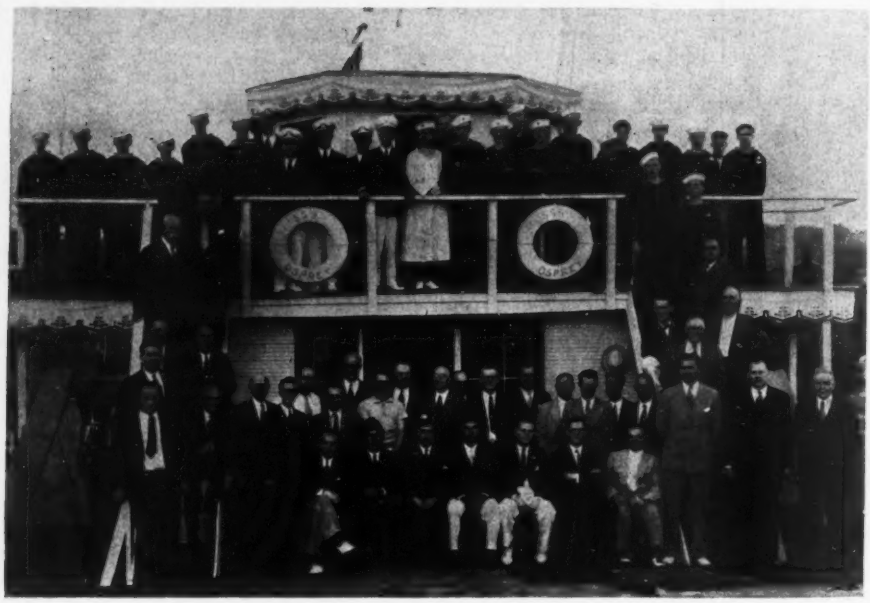
Students of the industrial-arts department in the Washington Irving High School at Tarrytown, N. Y., assisted in the building of a sea-scout base on the Hudson River.

For some time past, there had been a desire on the part of many of the older boy scouts of Tarrytown, N. Y., for a sea-scout unit, and the dream of the leaders was the development of a suitable base or headquarters to be built on a barge or flat boat.

During March, 1936, a local stone company, Cooney Bros., was approached with a request for one of their old boats. Mr. Frank Cooney, after some deliberation, turned over to the scout officials, a derrick barge, 110 ft. long and 30 ft. wide. Plans then went ahead for the construction of a main meeting hall adjoining the cabin. The cabin was 13 ft. deep and 22 ft. wide and the hall was planned to be 45 ft. long and as wide as the cabin.



The barge as it looked in March, 1936



Dinner group. June 6, 1936

The writer who also is the local scout commissioner, interested the shop students of the Tarrytown High School, in the undertaking, and they assumed the construction of the main hall, pilot house, and other necessary work.

Through the co-operation of the officials of the Chevrolet Motor Company, enough rough lumber was obtained to build the framework, gangway, and other projects. The only lumber purchased was the finished siding and flooring in the main hall.

In order to secure the roof rafters of proper strength and without too much expense, ten beams, 24 ft. long, 13 in. wide, and 3 in. thick had to be ripped their entire length. These were cut by hand, producing the twenty beams necessary.

The windows, stairways, door frames, ceiling braces, and council table were made in the school shop. All the drawings required were developed by the students in the mechanical-drawing class.

Superintendent of schools, Mr. J. Le Roy Thompson, and Mr. Oscar F. Koch, principal of the Tarrytown High School, gave hearty accord to the plan that the industrial-arts students undertake construction of the base. Mr. Thompson was especially interested, as he also is chairman of training in the local boy-scout council.

With the co-operation of the village board, a site was acquired adjacent to the village dump, and one of the eyesores of the town was transformed into a beautiful park, called Pierson Park, in honor of Mr. Frank R. Pierson, late president of the Tarrytown board of education for over thirty years.

Too much credit cannot be given to Mr. Chas. Vanderbilt, after whom the base is named, for the unlimited time he gave in contacting influential men, spurring on the boys, and helping in the solution of problems and also in the actual work to be done. Although Mr. Vanderbilt is over seventy years old, he is Tarrytown's Public Benefactor No. 1 when it comes to helping in worth-while projects. Other citizens of Tarrytown were liberal with gifts of time, materials, and money. All of this will be ever remembered by the sea scouts.

The sea-scout base was started in March, 1936, and the grand opening was held June 6, 1936. On that date, the sea scouts, headed by the high-school band, paraded from the high school to the sea-scout base where a band concert was held. Refreshments were served by the Tarrytown girl scouts.

The pictures show the completed base, the dump transformed into a park, the complete sea-scout personnel and the people on board the base June 6, also the benefactors, who dined on the base on the evening of that date.

It is felt that the following objectives were attained:

a) The conception and development of a plan.

b) The use of second-hand or salvaged materials.

c) Development of appreciation in the minds and hearts of youth.

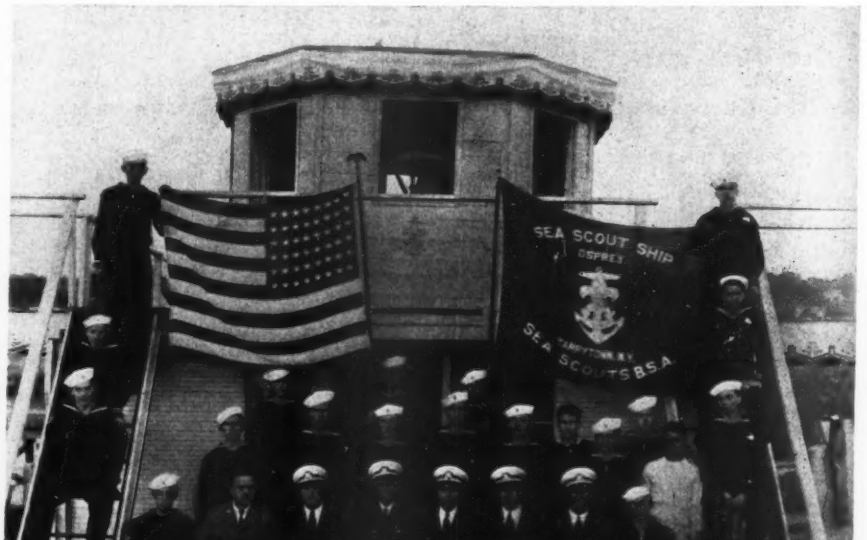
d) "Learning by doing."

e) Teaching of good citizenship as shown by the willingness of men to help in a worth-while project.

f) Teaching of the principles and worth of human values by the close co-operation of men and boys in a common purpose.

g) Creation of a thing of beauty from a barren waste (transformation of the dump into a park).

h) The "leading out" of the thoughts and aspirations of boys — education.



June 6, 1936

Probems and Projects

SECRETARY AND BOOKSHELVES

J. I. Sowers, Director of Industrial Arts, Miami, Florida

(See Supplement No. 337)

The supplement gives a good understanding of this ninth-grade project. It will be noted that the project is feasible even if woodworking power tools are not available.

The project is made as simple as possible, so that it may be within the ability range of the average junior-high-school student. Excepting the panels and the pigeonhole unit, only ¾-in. stock is used. Our object has been to have this secretary made by every student in woodwork in the junior high schools. In this way, every pupil is provided with a desk and book container for his homework during the remainder of his school experience.

Working Procedure

1. Make the four uprights. Lay out dado cuts for shelves, ¼ in. deep. Lay out a sufficient gain in back uprights to nail plywood back to cabinet part.

2. Prepare the four shelves. One of these is to form the bottom of cabinet. For this reason, it must be *11 in. wide*.

3. The two shelves that form the cabinet must be gained on the back edges to receive the plywood back.

4. Shape and set triangular bases in position. These are doweled and glued.

5. Shelves and uprights are fastened together with flat-head screws, covered by screw plugs. Square up and nail temporary brace to back.

6. Work out the two triangular pieces for front of cabinet. Cut stop dado in these to fit projecting shelf. Fasten in position with dowels and glue.

7. Cut and fit plywood panels to sides and back. Make center upright stay, and nail in position. Nail on battens to give effect of paneling.

8. Make desk lid. Insert *feather* in ends of lid, see detail sketch. Fasten lid with hinges and with desk-lid supports.

9. Make up pigeonhole compartment in one unit.

10. Desk lid may be decorated. Great care must be used in this. Design, if used, must be neat and well executed.

BLUEBIRD HOUSE

W. L. Dorrance, Lorain, Ohio

Everyone should be interested in providing nesting places for those birds whose habit it is to rear their young near the abode of man. Each year careful studies are carried on by the United States Department of Agriculture, and the results of these studies always show that, without the aid which the birds give in the extermination of insect pests, agriculture would be almost, if not entirely, impossible.

When the forests were cut down, many of the natural nesting sites of the birds were destroyed. This shortage of nesting sites can be made up, at least in part, by those individuals who build and place birdhouses on their premises.

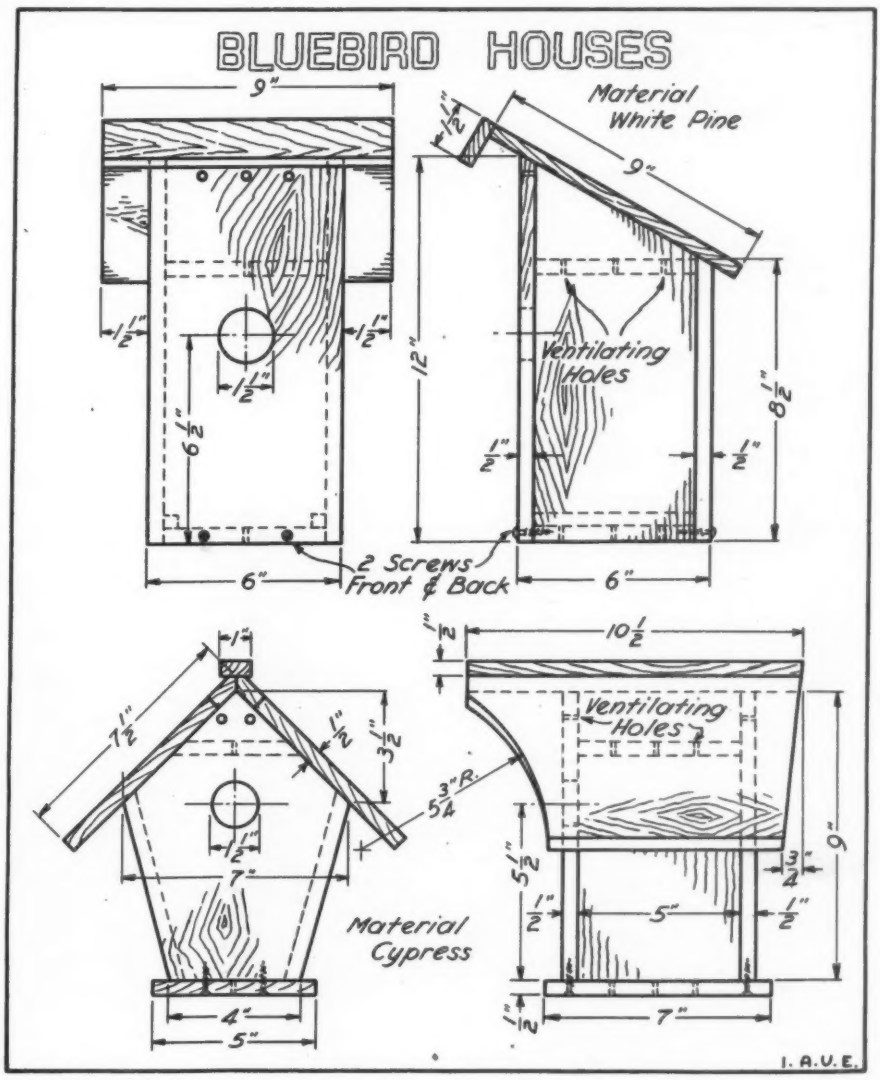
Long ago, the American Indians used to hang gourds from the lower limbs of the trees. Within these gourds the purple martin would nest, bringing delight to the red children as they played about the village.

The forests have been replaced by farms, and towns and cities, but still the birds return to the haunts of their ancestors. Here they build their nests in shrubs, eave spouts, chimneys, and the boxes made by man. The robin has always chosen a nesting site in the open. They will often build in rain spouting, only to have eggs or young destroyed by a heavy rain. This danger can be prevented by fastening a few shelves under the eaves of the house or outbuildings. The shelves should be fastened securely, and high enough above the ground to protect the birds from their many enemies. The shelf should be about 6 in. wide and 8 in. long. This allows plenty of room for the nest building.

During the spring migration and the nesting season which follows, the birds are very timid and suspicious of any marked change in their surroundings. If the houses are put in place early in the year, before the birds have returned, the action of the snow and rain upon them will leave a used appearance. Too often a nesting box is painted in some bright color. This has a tendency to frighten away the birds which otherwise might consider using it for a home.

It is very important that the birds have plenty of fresh water. This is especially true during the hot weather. A shallow pan fastened upon a post will make an excellent bird bath.

While it is true that birds will nest in



almost any kind of box, there are a few rules that should be followed in order to get the best results. If the box is intended for a bird whose natural nesting site would be in a cavity, such as a hollow limb of a tree, then the house should have the opening near the top. The size of the opening is an important factor in birdhouse construction. If the entrance is made too large, the tenants are likely to be molested by other and larger species. It is not necessary to have a perch at the entrance of a box.

It is a good plan to construct a birdhouse in such a way that the bottom or side may be removed. This allows for cleaning out the old nests. The bottom of the box should be drilled to take care of drainage and to allow circulation of air. Never put up a birdhouse made of metal. These become so hot during the summer months that the young sometimes suffocate.

When fastening the bird boxes in place, be sure that they are secure. A birdhouse, just as any other house, should be well built.

GAUGE FOR SHEARING BAND IRON

Jos. J. Lukowitz, Milwaukee, Wisconsin

When it is necessary to cut a large number of pieces of band iron to identical lengths so as to have them available for starting a class simultaneously on a project, some form of speedy production cutting is desirable. Teachers not having a bench shear or a floor shear will find a machinist's vise and a monkey wrench suitable for speedily shearing stock to length. Of course, the vise jaws and the jaws of the wrench must be in good condition. If the wrench jaws are not parallel they may be ground so.

Since it is very awkward to handle a 12 or 16 foot length of band iron and clamp it in the vise in exactly the right place for shearing, some form of support and length gauge is quite necessary. At A in Figure 1, are shown the details of a cut-off gauge which may be used as indicated at B and C in Figure 1.

Band iron ⅛ in. thick and ⅜, ½, or ¾ in. in width can be easily sheared to length in this device by any boy with a 12-in. monkey wrench. The slots in the wooden supports vary in depth to accommodate ⅜, ½, and ¾ in. widths of band iron. These supports may be made of wood or metal.

To use the gauge, clamp it to the vise as shown. Then clamp the two supports in place and adjust the stop to the required distance. Now slide the band iron through the slots in the supports until it contacts the stop on the gauge as shown at B in Figure 1. Then tighten the vise. Next swing the gauge back slightly and slip the jaws of a monkey wrench snugly over the band iron, as shown at C in Figure 1. Keep the face of the wrench jaws in contact with the end of the vise jaws. Swing the wrench down about one eighth of a turn and then up, above the horizontal, about one eighth of a turn and the metal will be neatly sheared off. Now loosen the vise, swing the gauge forward, slide the band iron up against the stop, tighten the vise, and shear off another length. All of this is but the work of a few moments and in an incredibly short time a large number of pieces, all cut to the same length, may be prepared.

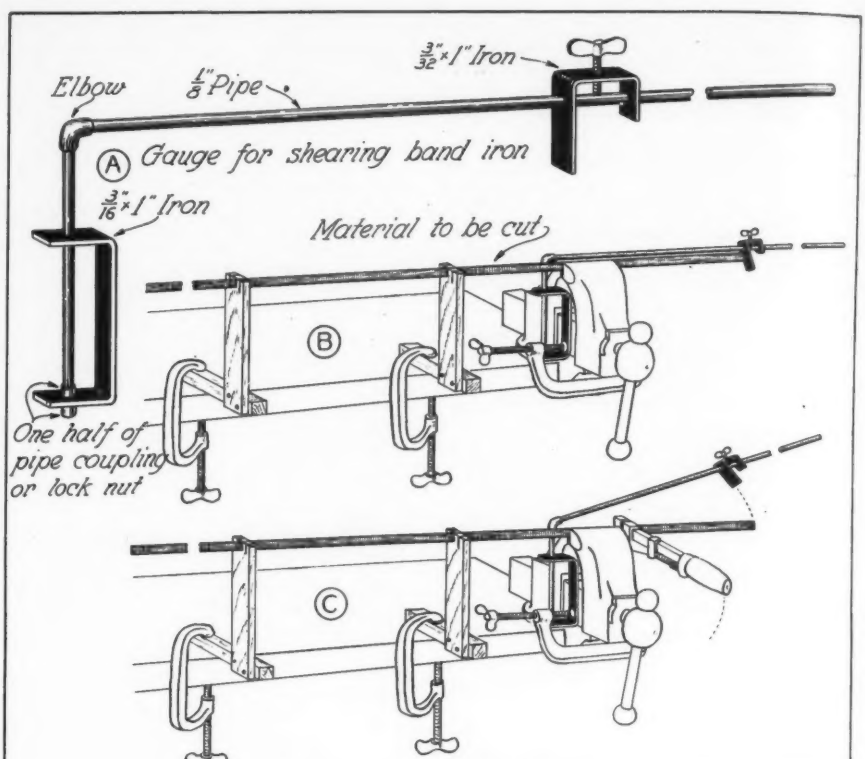


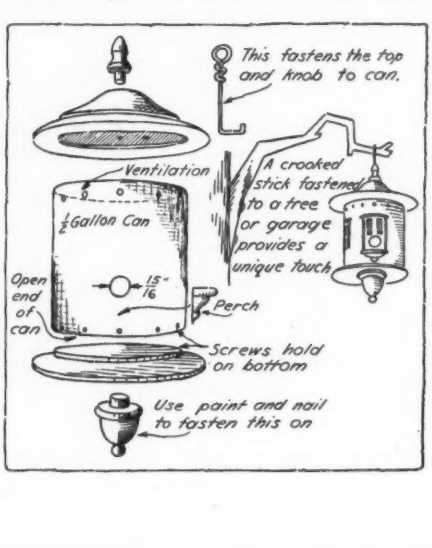
Fig. 1

A NOVEL WREN HOUSE

W. W. White, Central High School, Fort Wayne, Indiana

The birdhouse described in this article possesses a number of advantageous features: The material required is cheap; there are unlimited opportunities for original design; faceplate and spindle turning is required; metal and wood are combined in the project; various types of finishing may be employed, and, above all, when finished, a decidedly worth-while and useful birdhouse will have been produced.

The designs so far produced include numerous varieties from Japanese pergolas to hanging bullets. The bottom is fastened on with screws so that it is removable for cleaning-out purposes. These birdhouses should be hung in a shady place, otherwise the direct sun upon the metal sides will make them too hot.


This fastens the top and knob to can.
Ventilation
A crooked stick fastened to a tree or garage provides a unique touch
½ Gallon Can
Open end of can
15/16
Perch
Screws hold on bottom
Use paint and nail to fasten this on

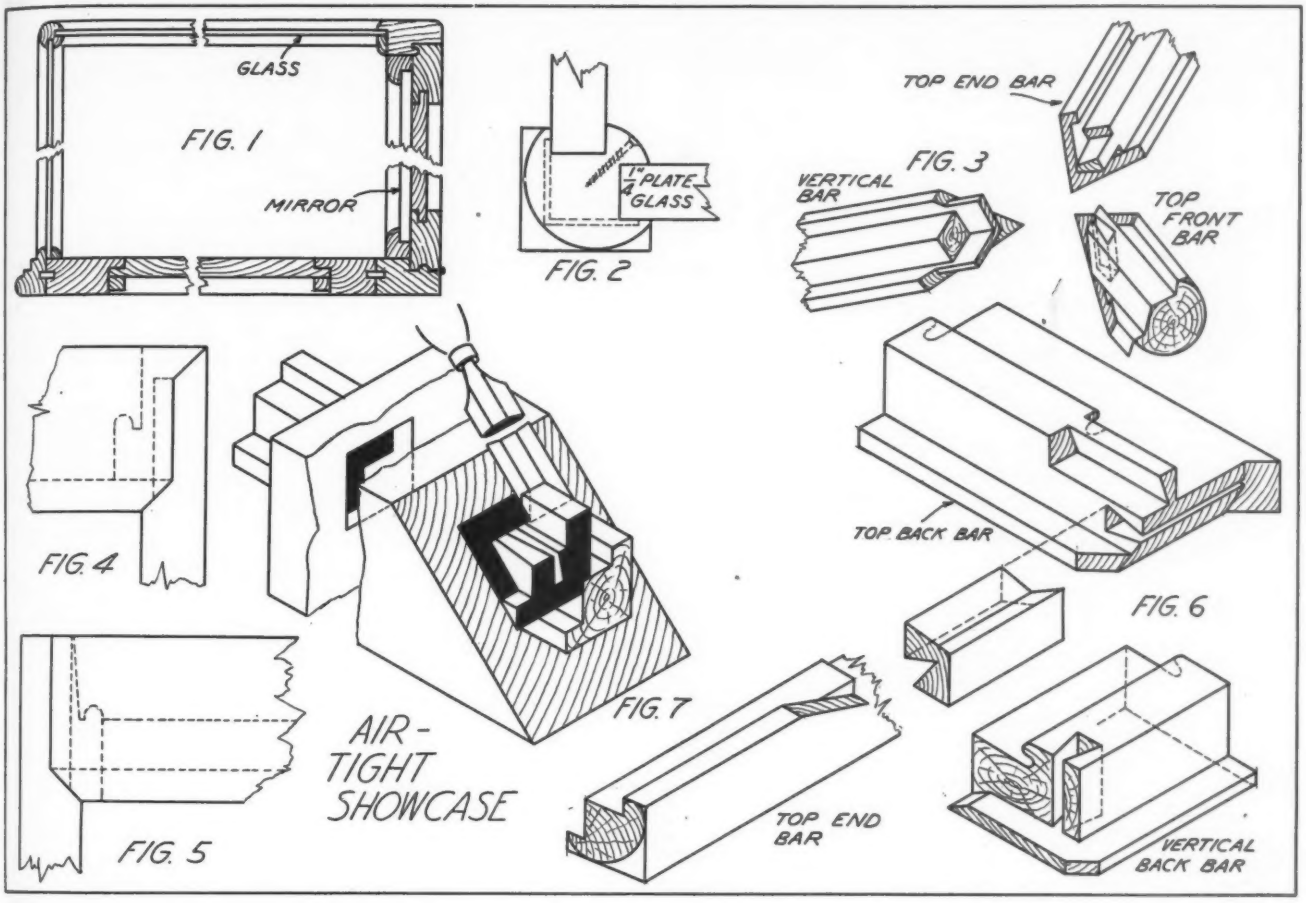
AIR-TIGHT SHOWCASE FOR THE SCHOOL MUSEUM

John Y. Dunlop, Auchnafreum, Meldroch, Kilfinan, Argyle, Scotland

The air-tight showcase is the result of a high degree of accurate workmanship. The example herewith given is confined to the typical example of showcase work. The methods of forming the special joints are the distinctive feature of this class of work and are the same in all cases irrespective of size or design.

Figure 1 is a cross section through the case showing the part of the front glass panel and the hinged back with the mirror glass in front. A section taken parallel to the front would show the mirror frame with shape of the hinged back. The vertical rails at the front of the case are ⅝ in. in diameter while the same rails at the back are ⅝ by 1½ in. and are checked to receive the hinged back.

Next to the property of air and dust tightness which is an essential feature in these cases, their most important qualification is that the woodwork in them is reduced to the smallest dimension which will keep the glass in position and give an uninterrupted view of the contents of the case. This slenderness of the surrounding frame renders it



necessary that the joints in it should be made with the greatest accuracy and care, and that the glass panels should fit the opening exactly.

The joints between the wood and the glass are sealed with soft putty made with white lead and boiled oil, the putty being stained to match the wood of the case.

Figure 6 illustrates the back joints at the top of the case, Figure 3 the front joints at the top of the case, and Figure 4 the plan. Figure 5 is the elevation of the joints shown at Figure 6 when fitted together. Figure 2 is the section of the ⅝-in. angle bar. Figure 7 is the type of miter trap used for cutting those joints the use of which will will be self-evident from the sketch.

The wood usually employed for this kind of work is mahogany. All the miters in the standards and rim are made before rounding the edges. Once rounded up, the finish should be applied. This prevents the oil exuding from the putty, from staining the wood. The top of the frame should be glued up first, the front corners being completed by the insertion of the vertical angle bars.

The bottoms of the vertical bars are simply stub-tenoned into the base. In rounding off the outer corners of the bars care should be taken not to plane off too much wood which would, of course, expose the hidden joints. Owing to the fineness of the points in these cases, great care should be taken in selecting firm and straight-grained wood. This should not be a difficult matter since there is so little wood used in a project of this kind.

WATERPROOF MATCH BOX

Carl Abrams, High School, Port Huron, Michigan

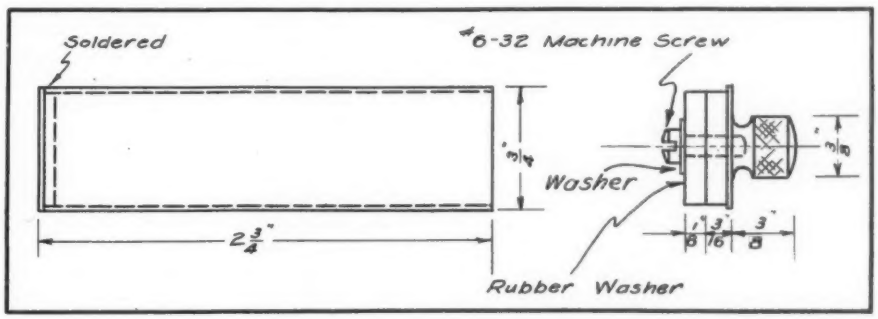
This match case can be made in several sizes. The illustration shows the most popular size using 20-gauge shotgun shells for the ends. This case holds about 14 matches. The most convenient size, however, is made of ¾-in. brass or hard copper tubing with 12-gauge shells for the ends. Old brass chandelier stock is excellent for this project, and generally available. The rubber washer is made slightly tapered for easy insertion, and a brass washer is placed under the machine-screw head. The knob may be soldered into the cap hole making a solid top, or it may be left free to turn in the cap hole in which case a slight turn on the knob expands or contracts the washer. The machine screw will not turn if soldered to the brass washer. The paper is removed from the bottom shell and the cap flattened and soldered in place, but in the top shell, the paper is left, making a flat surface for the washer to fit against.

LEATHER FILE OR SCREW-DRIVER HANDLE

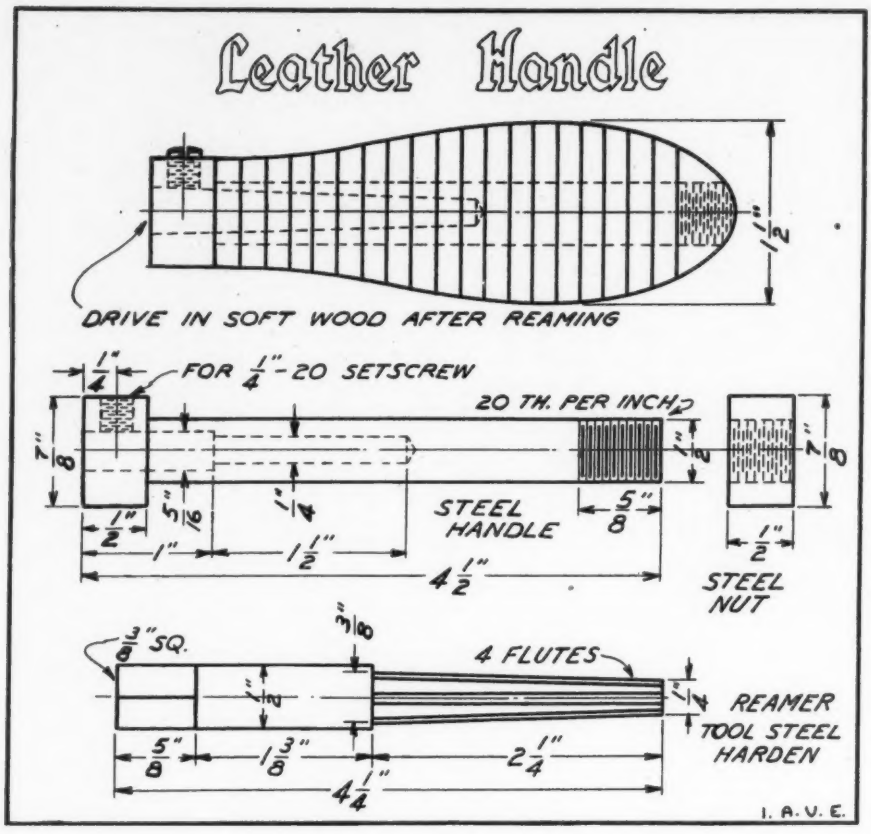
George C. Abbe, Hartford, Connecticut

The serviceable file or screw-driver handle, described herewith, can be made out of old leather belting. A piece of softwood is driven into the tapered hole. A small hole is then started in the wood just as is used in any all-wood handle. The setscrew holds the tang of a file or screw driver firmly.

The shape of the handle may be made to suit individual tastes.



Waterproof match box



The reamer shown was made in the school shop, but any taper-pin reamer of the proper size may be used instead.

AN A.C.–D.C. RADIO RECEIVER

Gilbert Oberweiser, Milwaukee, Wisconsin

Part II — The Amplifier

In the article on page 382, of the December, 1936, issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, the problem of supplying the energy to operate the receiver was discussed. Now the audio-frequency amplifier will be considered. This may seem the reverse of the natural procedure (since the incoming radio waves are first tuned and rectified by the detector, then amplified by the audio-frequency amplifier) but the reason for this reversal of the usual order is that it is more convenient to test the individual units if built in this way.

Theory of Operation

Radio signals picked up by the antenna, tuned and detected, are not nearly strong enough to be heard from a speaker. To step up or increase the amplitude of this signal voltage, an amplifier is employed. In other words, the amplifier makes it possible to obtain a much larger alternating voltage, signal strength, or power, at its output than is impressed across its input. However, it might be mentioned that this characteristic of gaining power is by no means a contradiction to the law of conservation of energy, for the additional power, which characterizes the gain, is supplied by the power pack.

Now consider a signal which has been detected. This audio-frequency signal is analogous to an alternating voltage (Eg_1) which is impressed across the input of the tube. See Figure 1.

The construction of the three-element tube is such that the grid voltage has a much greater control over the plate current (Ip) than the plate voltage has. Here again the principle involved is somewhat like that of the thermonic rectifier discussed in the last article. The grid (a mesh of wires) is located between the cathode and the plate. As the electrons are emitted from the heated cathode, causing a plate current to flow, they must pass through the grid. The grid has a fixed negative bias to prevent the flow of any grid current. However, superimposed upon this fixed bias is the alternating voltage (Eg_1) which varies the net grid voltage. Since the geometry of the tube is such that a small variation of this grid voltage will produce a relatively large variation in plate current, it can be seen (see Fig. 1) that the voltage drop across the output resistor (R_2), which is connected in the plate circuit of this same tube will be fairly large when compared to the varying input voltage. Thus, summing it all up, the variable Eg_1 causes a variable Ip which causes a variable voltage drop across the output resistor R_2.

The ratio of this output voltage to the input voltage is called the gain of the amplifier. Eg_1 and Ip, however, refer only to the alternating components of grid voltage and plate current, and not to the steady states caused by the battery B_1, as the main interest here is concerned with amplifying the alternating voltages.

The grid bias on the 76 tube in Figure 1 is produced by the voltage drop across the resistor R_1 in the cathode circuit. That is, the plate voltage supplied by B_1 causes a steady-state plate current to flow, the plate being at a higher potential than the cathode, and the cathode, since it is in the same circuit, is correspondingly at a higher potential than the B minus due to the IR drop through resistor R_1. Or, the B minus is at a lower potential with respect to the cathode. Since the grid return is connected to the cathode through the volume control, the grid will be biased negative by the amount of voltage drop across R_1.

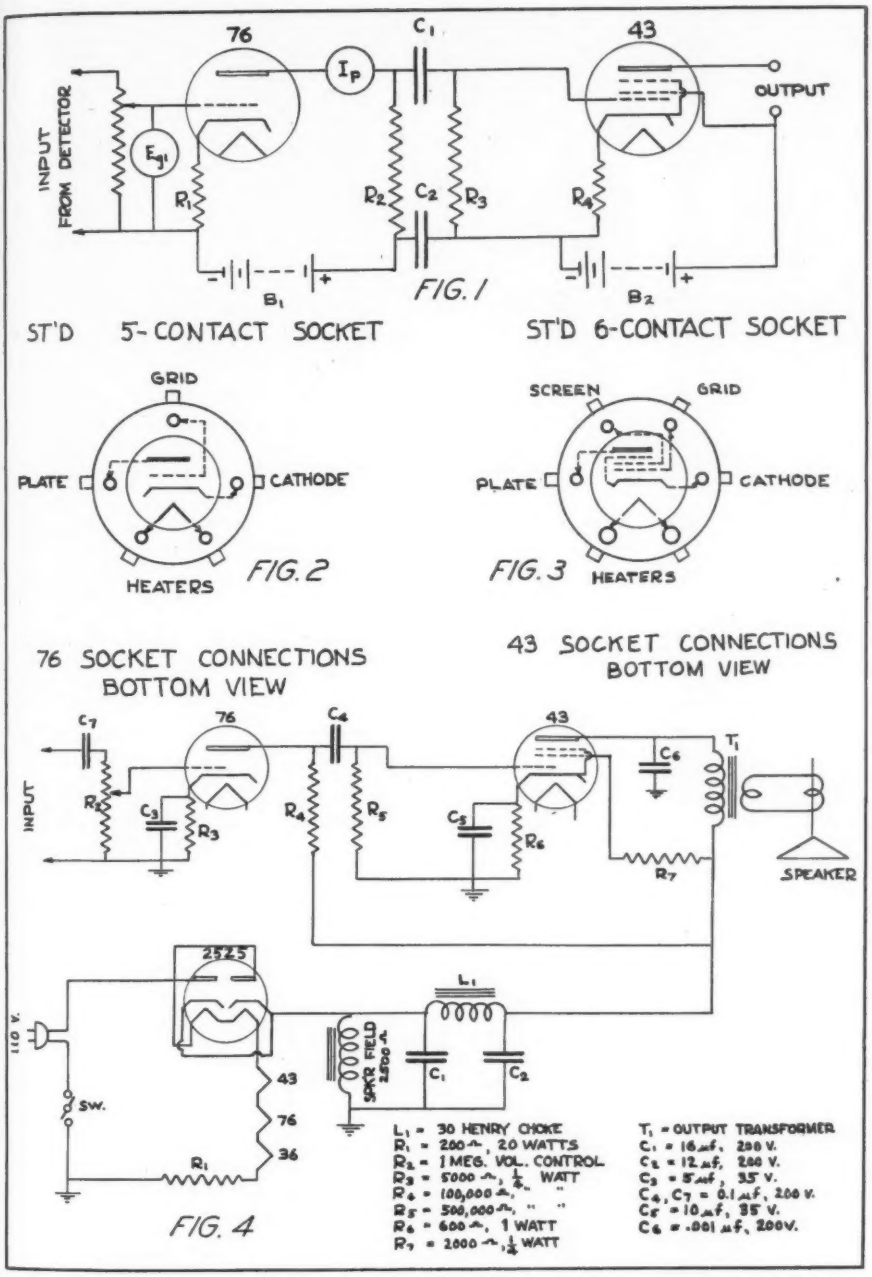
Now the impressed voltage has been amplified through one stage and is ready to be amplified again. If it were not for the fact that the grid of the following tube must also be kept negative with respect to its cathode, the grid of the 43 could be connected directly to the plate of the 76. But this grid must also be biased negative, which is done in the same manner as with the former tube. The electrical connection between the output of the 76 and the input of the 43, however, is completed by condensers C_1 and C_2, both of which offer very low impedance to alternating currents or voice signals, but insulate the steady-state voltages of the two circuits from each other so that the proper operating conditions of both tubes can be satisfied at one time.

Since the condensers C_1 and C_2 offer very low impedance to alternating currents, the alternating voltage across the output resistor of the 76 is impressed, with very little loss, across the input of the 43 tube.

Now the voice signals are again amplified as before. The construction of the 43 pentode tube, however, is different than that of the 76 inasmuch as it has two more grids, a screen grid and a suppressor grid. That is, the elements of the 43 type of tube are so placed that higher amplifying characteristics may be obtained, and are also arranged so that a relatively large amount of undistorted power output may be obtained.

A brief explanation of the function of the two extra grids of the pentode type tube is this: The screen grid is placed between the control grid and the plate in such a position that it helps the flow of electrons between the cathode and the plate, since the screen is biased highly positively and helps attract the electrons. In other words, in order to obtain high amplifying characteristics from a tube, the control grid must be placed relatively close to the cathode with respect to the plate. This makes it necessary to increase the distance between the cathode and the plate. Then, to prevent a condition whereby many of the electrons emitted from the cathode would not have enough velocity to travel to the plate, the screen grid is inserted between these two elements and biased with a positive voltage so that it tends to help the electron flow without taking much of the current itself.

Now, however, the velocity of the electrons flowing to the plate may be increased so



much that when they strike the plate they may bound back and cause trouble. This rebounding from the plate is called secondary emission. Thus, another element is introduced, the suppressor grid. This is located near the plate and is connected to the cathode inside the tube, allowing the electrons which constitute the secondary emission, a path by which to flow harmlessly back to the cathode.

The 43 pentode, with this arrangement then, provides a high amplification and at the same time is capable of a relatively large power output which is necessary to operate a speaker connected across the terminals marked "output."

The diagram of Figure 1 has served well enough to explain the theory of the amplifier, but this has been more of an outline than a complete circuit. The complete amplifier, with the dynamic speaker and power pack connections, is shown in the amplifier diagram of connections, Figure 4.

There are few things here that can stand discussion. It will be noticed that the biasing resistors (R_3 and R_6) of the 76 and 43 are shunted by large by-pass condensers. These condensers (C_3 and C_5) shunt the alternating component of the cathode current around the biasing resistors, preventing the resistors from having a degenerative effect upon the impressed grid voltage. This may be explained as follows: An alternating voltage is impressed across the input of the 76 tube. This produces an alternating plate current. The plate current will produce an alternating voltage drop across its cathode resistor (R_3), which, because the plate current increases with the impressed grid voltage, will be 180 degrees *out of phase* with the originally impressed grid voltage. Thus to prevent this tendency of the alternating voltage drop across the cathode resistor of a self-biased tube to cancel out the originally impressed voltage, a large condenser with a very small a.c. voltage drop is shunted across this resistor which allows the a.c. to pass through it but allows the tube to maintain its original bias.

The output transformer (T_1) should be one which will match the 43 tube. Output transformers are generally included on dynamic speakers.

Coupling condensers (such as C_4) are generally of the paper type, while the large by-pass and filter condensers (C_1, C_2, C_3 and C_5) are of the electrolytic type. It might be mentioned here that it is important to connect the electrolytic condensers so that their polarity is correct, otherwise they will not act as condensers.

Construction Notes

As this is a rather high-gain amplifier, care should be taken that undesirable feedback will not take place. The grid leads should be as short as possible. Grid and plate leads should not run parallel. It may even be necessary to use shielded wire for the grid lead of the 76 tube.

It will be noted that in Figure 4 the heaters of the tubes and the speaker field are drawn separately in the power pack. This was done merely to make the diagram simpler.

Again, as was mentioned in the last article, the ground connections denoted in the diagram of connections are to the chassis. No external ground should be used.

To test the amplifier circuit, a phonograph pick-up or microphone may be connected across the input of the circuit. Or even a low a.c. voltage, taken off the 110-volt line and cut down to about 1 volt, may be used as a test. If the latter is done, however, the connection should be made through a condenser, or a transformer should be used, otherwise a short circuit across the line may take place.

The cost of the amplifier, including the speaker and tubes, is estimated to fall somewhere between $3.50 and $5.

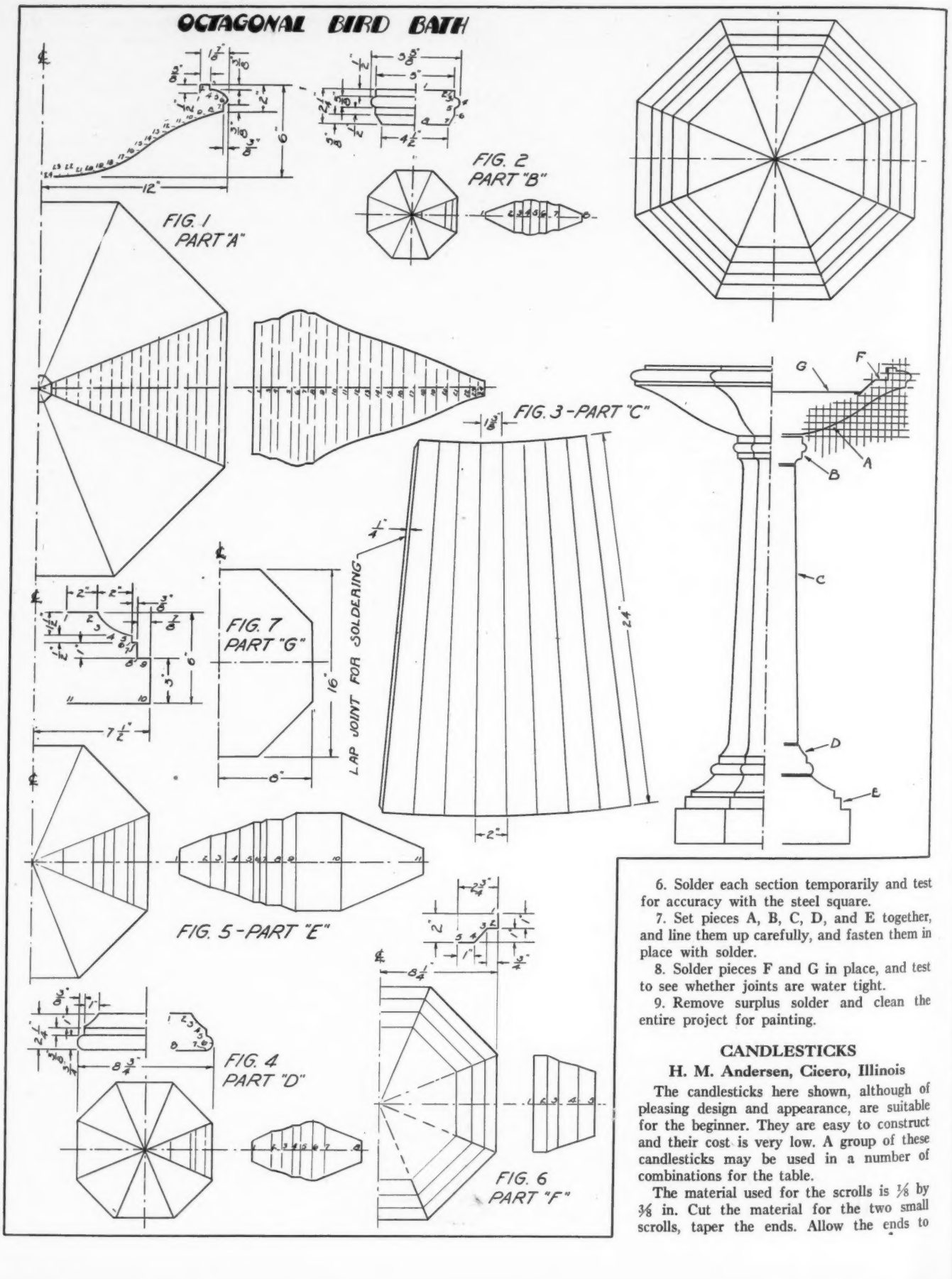
OCTAGONAL BIRD BATH

Harry W. Kroll, Buhl, Minnesota

The bird bath shown herewith is made of No. 26 galvanized iron. As is evident from the illustrations, this project is intended for the advanced student who has learned to work carefully and accurately.

The method of procedure is as follows:

1. Make a layout for the various parts.
2. Transfer the pattern to the galvanized iron.
3. Indicate where folding is to be done on the cornice brake, by small prick-punch marks. These marks also will be visible on the reverse side, which is necessary, since several of the pieces have to be reversed for making the proper folds.
4. Cut out all of the pieces required.
5. Fold all the pieces on the brake.



6. Solder each section temporarily and test for accuracy with the steel square.

7. Set pieces A, B, C, D, and E together, and line them up carefully, and fasten them in place with solder.

8. Solder pieces F and G in place, and test to see whether joints are water tight.

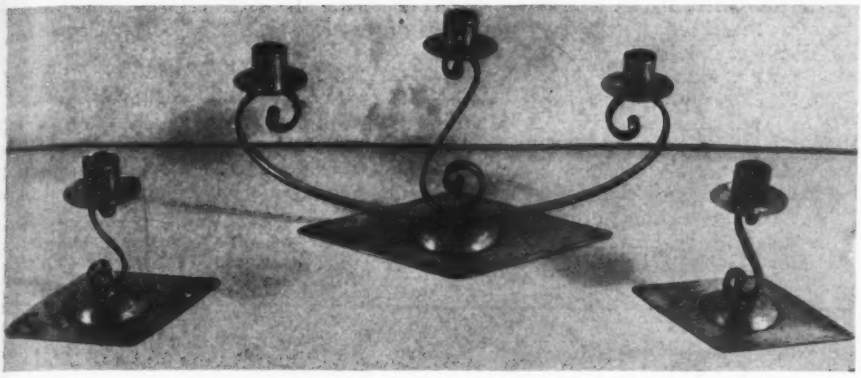
9. Remove surplus solder and clean the entire project for painting.

CANDLESTICKS

H. M. Andersen, Cicero, Illinois

The candlesticks here shown, although of pleasing design and appearance, are suitable for the beginner. They are easy to construct and their cost is very low. A group of these candlesticks may be used in a number of combinations for the table.

The material used for the scrolls is ⅛ by ⅜ in. Cut the material for the two small scrolls, taper the ends. Allow the ends to



spread a little in width as they are tapered in thickness. The scrolling is done in a piece of slotted ½-in. pipe. The scrolls are formed hot and trued with a pair of tongs. Care should be taken not to get this type of candlestick too high. The base is made of blue annealed sheet steel. It is well to raise the center of the base, for welding will warp the flat piece. The tray and the cup are made of the same kind of material as the base, only of a lighter gauge. The tray is dished slightly and welded to the scroll. The cup is formed and welded along the side and then soldered to the cup by use of the torch. With the two smaller candlesticks finished, it is easier to strike the proportion for the larger and more difficult one. The longer piece is cut first, forged and scroll. Now estimate the length of the piece needed for the large S scroll. This scroll is formed the same as the smaller scrolls only over a larger pipe. The base is cut proportionally larger, and the three are welded together. The trays and cups are made the same size as the others.

The finish is in the natural color of polished iron. Care should be taken not to polish wrought iron too highly. Also no marks from the ball peen of the hammer should be distributed over the problem. Hammer marks should be only those necessary for the forming of the problem. If no preparation is on hand for preventing corrosion, a good furniture polish will be suitable.

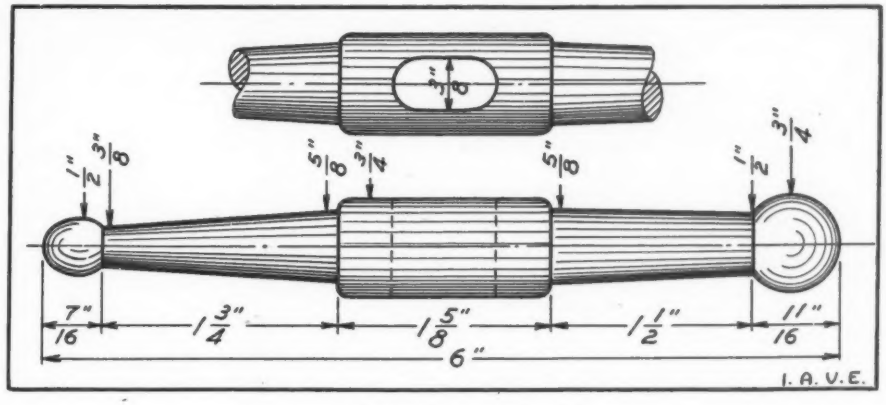
EMBOSSING HAMMER

Henry J. Kauffman, Springfield High School, Delaware Co., Pennsylvania

Copper, brass, pewter, and bronze are becoming increasingly more popular as media in the industrial-arts courses of the high school both for boys and girls. A wide range of hammers is essential in this type of work. The drawing indicates a type that can be made by the average boys in the school shop. The shape of the hammer is optional, although years of experience have shown that this one is satisfactory. The large end is good for general raising problems, while the small end is useful for edges and delicate hammered work.

All the lathe work except the polishing, is completed first. Then the eye is drilled, after which the ends are hardened. The scale caused by the hardening is then removed on the lathe, after which the final polishing is done. Directions for all the processes involved can be found in any good book concerning lathe work.

This is not only a shop lathe problem, but is an opportunity for the boy to make a serviceable hammer for himself, and thereby become permanently interested in one of the oldest of crafts — one equally as rich in aesthetic appreciation as it is in practical application.

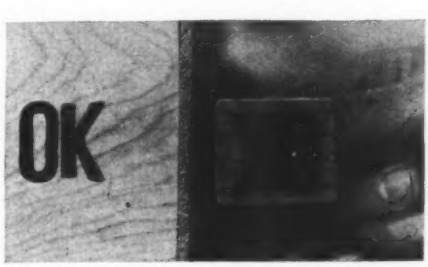


Embossing hammer

HOMEMADE RUBBER STAMP

Frank Bentley, Jr., Clinton, Iowa

Initials, identification marks, and OK stamps may be quickly and easily made as shown in the illustration. The soft-rubber letters O and K were taken from one of the inexpensive school rubber-eraser character sets. They were glued to a small block of wood. A portion of a spool was fastened with a screw to the other side of the block for a handle. The improvised stamp works very well, and gives clear and distinct impressions when used with a well-inked pad.



SQUARE MATCH-BOX HOLDER

William J. Becker, Boynton Junior High School, Ithaca, New York

Although small in size, this safety match-box holder involves more operations than most projects of equal size. It makes an excellent table piece, its copper hues blending with most furniture.

Material required: 1 piece of 18-gauge copper, 3½ by 2¼ in. for top; 1 piece of 18-gauge copper, 2 3/16 by 2¼ in. for bottom.

Directions

1. Make bill of material and have instructor approve it.
2. Cut out material as specified.
3. Draw lines in large piece of copper as shown in Figure 2. Draw in following order: Center line, A, B, C, D. (*Note:* Use a sharp-pointed pencil. A scriber would scratch the copper.)
4. Draw lines for slot, through which matches will be struck. See Figure 3.
5. Drill holes for saw. Punch these about 1/16 in. from each corner. See Figure 3. *Caution:* The entire hole must be in waste portion of the work.

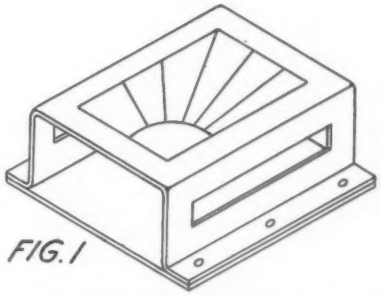


FIG. 1

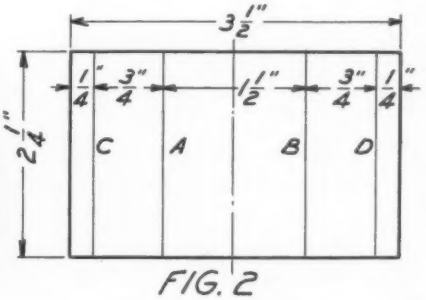


FIG. 2

6. Saw out the slots with a jeweler's saw.

7. Use small files and file the slots until they are rectangular. Present the work to the instructor for inspection.

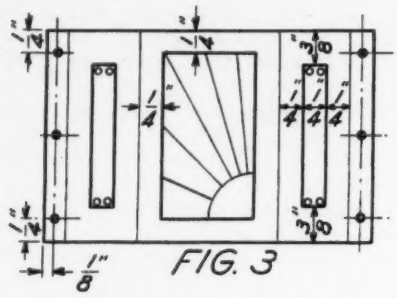


FIG. 3

8. Locate rivet holes as shown in Figure 3.

9. After locating holes with a light prick-punch mark, drill them with a No. 42 drill.

10. Draw the design on the metal with a pencil. See Figure 3. Present work to instructor for inspection.

11. Chase design. To guide your work, it is a good idea to clamp a straight piece of sheet metal on the line that you are chasing.

12. Bend top to shape, following the lines shown; use a light rawhide mallet.

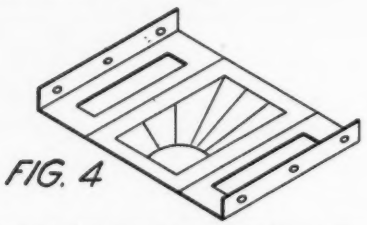


FIG. 4

a) Make bends as shown in Figure 4. Clamp so that line is at edge of stake and bend in the same direction as the design.

b) Make remaining two bends. To avoid metal bending at slots, clamp a ¼-in. bar of metal over the slot. See Figure 5.

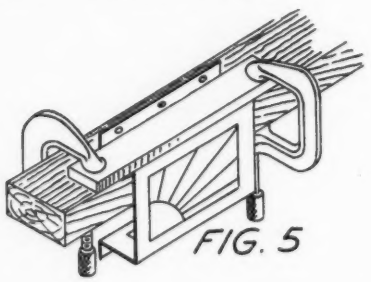


FIG. 5

c) Square up entire form and try match box in place.

13. Fit top to bottom of match-box holder and carefully mark *two holes*, one on each side.

14. Punch *lightly* with prick punch and drill with a No. 42 drill. File off burrs.

15. Get two rivets of proper size and after checking size with instructor, cut off and rivet.

16. Drill four other holes and rivet.

17. Clean entire match box with steel wool, holding with a paper towel to avoid finger marks.

18. Place in liver-of-sulphur solution for about two minutes or until it turns black; rinse with water.

19. With small damp cloth on which pumice stone has been *lightly* dusted, rub the sun on the design until it shines; also rub off two other spots on the sides.

20. Wash off pumice stone and blot dry.

21. Give a coat of lacquer to preserve finish.

References

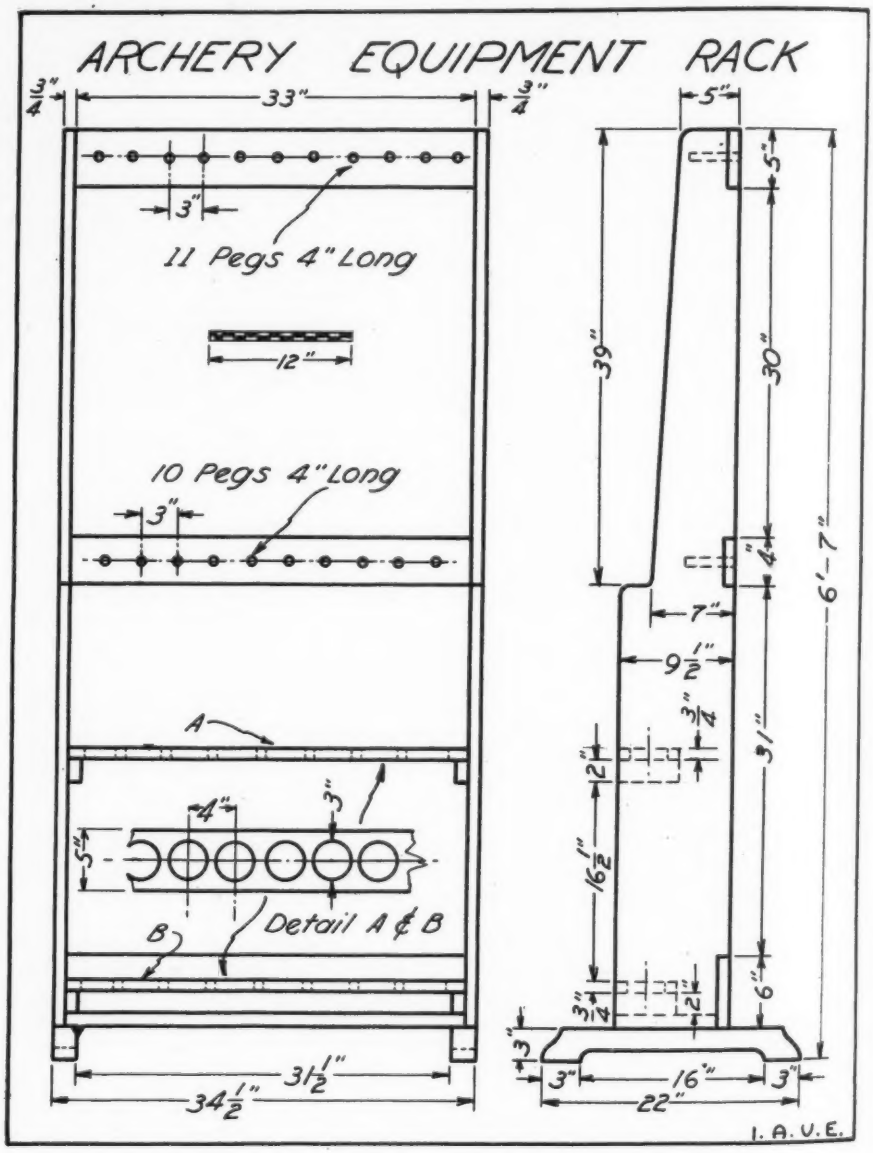
A. *Essentials of Metal Working*, Berg and Wing, Manual Arts Press, Peoria, Ill.

B. *Metal Work*, Jones, Bruce Publishing Co., Milwaukee, Wis.

ARCHERY RACK

George W. Bowen, Salem, New Jersey

The archery rack presented herewith was found to be quite useful in keeping the archery tackle in order in the physical-education department of the New Jersey State Teachers College. Two of these racks are in use in the women's department and one in the men's.



Questions

1. Give several uses of brass (Reference A, p. 74).

2. Just how and when is the behavior of copper opposite to steel? (Reference A, p. 71.)

3. Tell why it is advisable to use a metal guide whenever possible, during the chasing operation.

4. What is a "pickle" and how is it used in connection with copper work? (Reference B, p. 50, paragraph 3.)

5. Rivets used in the making of small boats are frequently made of copper. Why is this done? (Reference B, p. 54, paragraph 3.)

Dedicate Graphic-Arts Building

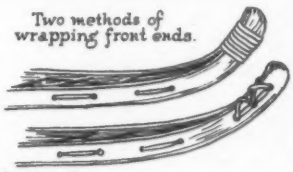
The State University of Iowa has dedicated two new buildings, which are to be devoted to the fine arts — one for graphic and plastic arts, and the other for dramatic arts. The new buildings are located on a thirty-acre plot of ground and are the first buildings of a unit to comprise a complete fine-arts division.

The graphic and plastic arts building, which was erected at a cost of $200,000, was made possible through grants from the Carnegie Corporation. It is the central unit for a group of smaller connecting studios.

ALASKAN ESKIMO SNOWSHOES

DESIGNED AND DRAWN BY W. BEN. HUNT, HALES CORNERS, WIS.

Alaskan Eskimo Snowshoes



To facilitate the bending of snowshoe frames the author has chosen this type of snowshoe for boys and novices. Snowshoes with this type of frame were used by Alaskan Eskimos and also by Chipewyan Indians.

By using green wood and bending it a little at a time, the same result is obtained as by steaming. By using green saplings one is also usually sure of straight grained wood. Allowing the bent frames to dry out for a week in a dry place (near a stove or furnace) is sufficient.

1. First get the form or forms ready. Use a 2"x10" plank 4' long and round off one end as shown in Fig. 1.

Fig. 1. Fig. 2

Cut 2 pieces of hardwood for the spreaders (Fig. 2) and fasten them to the plank. Fig. 3.

Fig. 3.

2. Now select 4 live elm or ash saplings measuring about 1½" to 1¾" at the butt ends and about 4' or 4½' long. While still fresh, trim them square with a drawknife and a spokeshave, to ¾"x¾" in the mid-section and tapering to ¾"x½" at the ends. Chamfer the edges.

3. There are several ways in which the front curves may be bent, two of which are shown here.

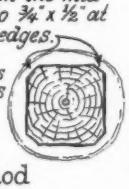
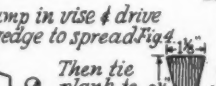


Fig. 4.

1st Method

Clamp in vise & drive wedge to spread Fig. 4.

Then tie plank to vise as shown in Fig. 5, place a prop under the other end and slowly bend both strips until they can be hooked under the first spreader. Then pull the tail ends together and clamp 6" from the end. Figs. 5 & 6.



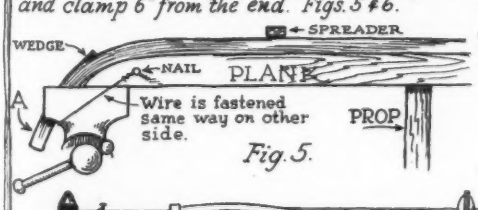


Fig. 5.

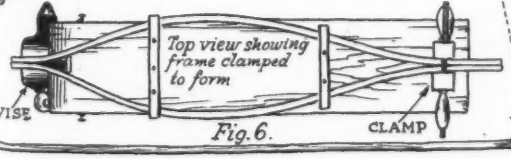
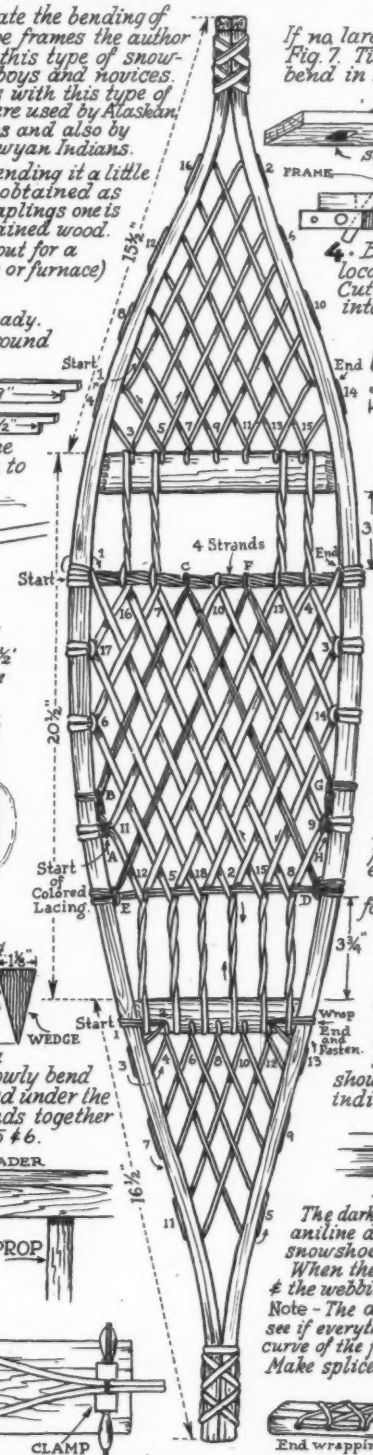


Fig. 6.



2nd Method

If no large vise is handy, make a jig as shown in Fig. 7. Tie or clamp the front ends together and bend in same manner as in 1st Method. Allow a week to dry.

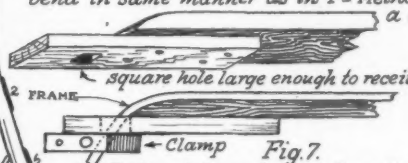
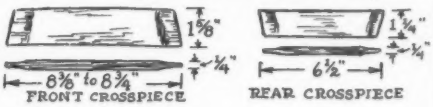


Fig. 7.

4. Before taking frames from forms, mark the locations for the crosspieces (see large drawing). Cut the crosspieces of hardwood and fit them into mortises in frame, cut ¼" to ⅜" deep.

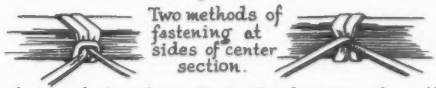


5. Wrap front end tightly with wet rawhide, set crosspieces into mortises, pull tail ends together and wrap.

WEBBING

Eskimos use walrus hide and Indians use rawhide for webbing. The snowshoes shown in the upper left hand corner are webbed for crusted snow. If no rawhide is obtainable, use so-called rawhide belt lacing, cut ⅛" wide for the ends and ¼" wide for the middle section. Either type of webbing should be thoroughly soaked before using and put on while wet. The detailed drawing shows the method of webbing. Lace the front & rear sections first. It is advisable to make a tracing of the frame on paper & then lay out the webbing on the paper first. Do not pull rawhide too tight as it may pull the frame out of line when dry. Just pull it moderately tight. About 12 feet of ⅛" lacing is used for the front end and about 6 feet for the tail end. About 28 feet of ¼" is used for the middle. Be careful to weave over and under uniformly as shown. Webbing at ends is drawn thru ⅜" or ¼" holes in frame & crosspieces. Numbers show order of procedure.

For the middle webbing, start where indicated & go across & back twice, making 4 strands, then go under & over, & proceed in numerical order, twisting and fastening as shown at left. The darkened strand is then woven in, fastening where shown, and following the alphabetic order as indicated, finally fastening end at H.

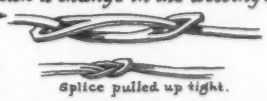


The darkened strand may be dyed red or green, by putting aniline dye in the soaking water, and will give the snowshoes an added bit of decoration.

When the rawhide has dried thoroughly give the frame & the webbing 2 or 3 coats of good spar varnish.

Note - The author suggests lacing with heavy cord first to see if everything will work out right. A change in the curve of the frame may mean a change in the webbing also.

Make splices as shown.



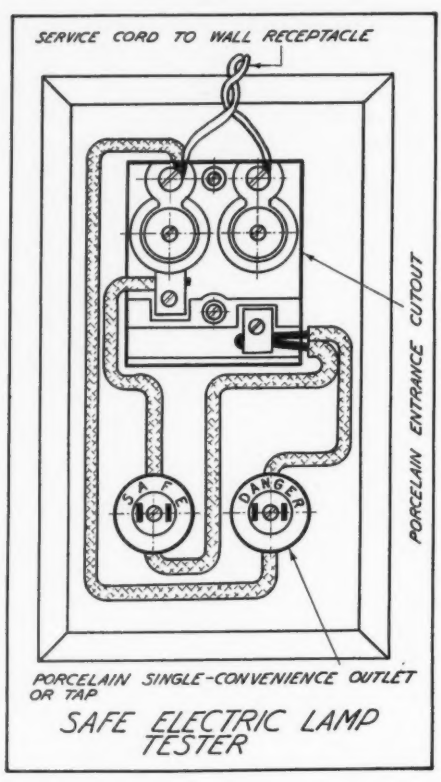
Owing to lack of space, the harness for this snowshoe is not shown. The one shown on the snowshoe on page 320 of the October, 1936, issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION *may be used*

A SAFE ELECTRIC LAMP TESTER

Leonard Wright, Jersey City, New Jersey

Every school shop in which an electrically lighted project is made, should have some way of carefully and safely testing the cord, the plug, and the fixture after the pupil has assembled it.

To make such a device, secure a porcelain entrance cutout, two porcelain single-convenience outlets, a cone-type screw-base heater element and one 10-ampere plug fuse. Mount the entrance cutout and the outlets on a prepared baseboard and wire it with No. 14 rubber-covered wire as shown in the illustration. Then add a proper length of service cord with a receptacle plug.



SAFE ELECTRIC LAMP TESTER

In the left-hand socket of the entrance cutout, place a cone-type heater element, the kind used in electric reflector heaters, which can be bought at almost any ten-cent store. In the right-hand socket of the entrance cutout place a 10-ampere plug fuse. Mark the left-hand convenience outlet with green paint and with the word SAFE and mark the right outlet red and with the word DANGER. Now the tester is ready for service.

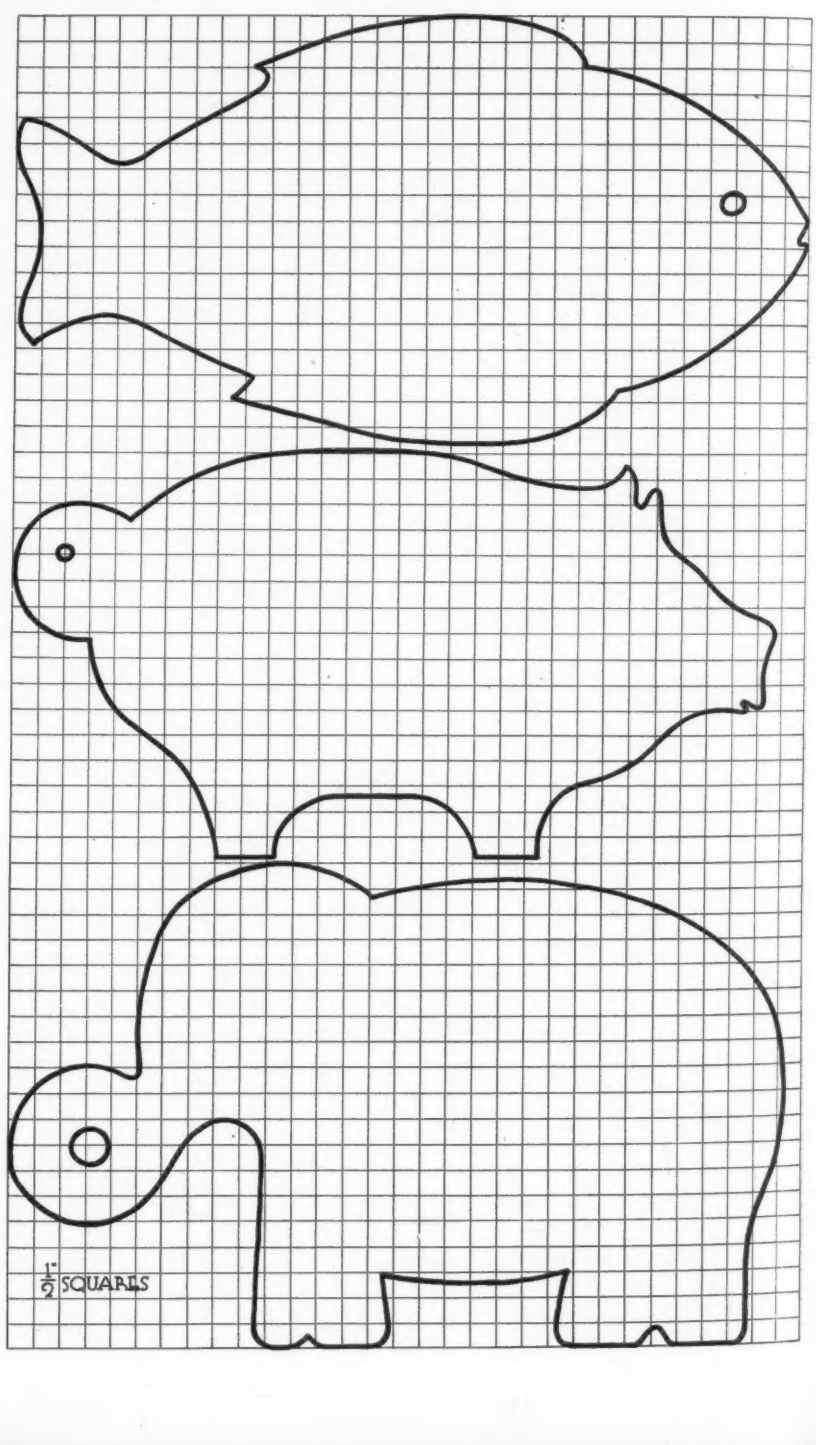
Note that there is no switch on the tester. To use the tester, place the receptacle plug of the tester into the wall receptacle and place the receptacle plug of the lamp to be tested, into the green, or safe outlet. If the lamp is in good condition, it will light and it is then safe to place the plug in the red, or danger outlet or into any wall receptacle. If there is a short circuit in the lamp, it will not light but the heater element will slowly become red hot. If there is an open place in the circuit, the lamp will not light neither will the heater element become red hot.

The tester is at all times protected by the fuse so that, when the green outlet is used, both the heater and the fuse are in circuit and when the red outlet is used, the current goes directly through the fuse to the lamp being tested.

MEAT-CUTTING BOARDS

Louis F. Barocci, Cudahy High School, Cudahy, Wisconsin

The cutting boards illustrated have an added appeal of novelty to the boys making them, as well as practicability when completed. The board can be made of either maple or birch or any other practical close-grained hardwood found in the school shop. The edges can be enameled to harmonize with the kitchen enamel.

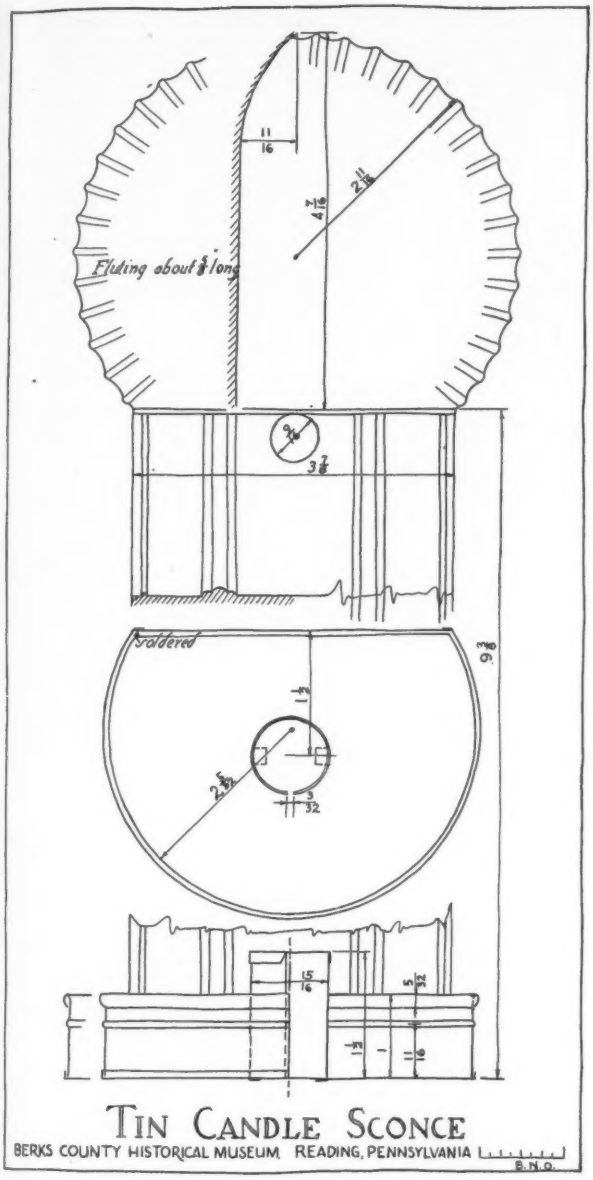


PAGES FROM A MUSEUM SKETCHBOOK

Burl N. Osburn, State Teachers College, Millersville, Pennsylvania

Tin Candle Sconce

The design of this wall light has been the inspiration for many modern lights done in tin or pewter. The back and bottom are in one piece. A rim with rolled edge is soldered to the burred edge of the bottom. The socket is a piece with a single-lap edge, left open in



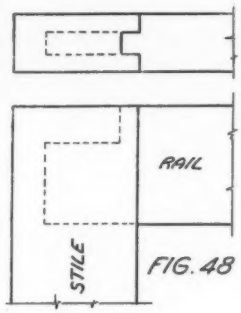


FIG. 48

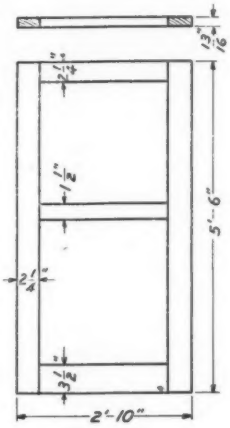


FIG. 49

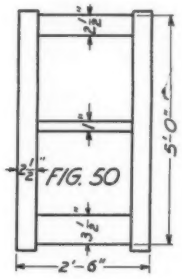


FIG. 50

the front, and fastened to the base by means of two small laps which go through slots in the base and which are soldered to the bottom. The fluting on back and top may be done between two pieces of wood. It adds much to the appearance.

THE MORTISE-AND-TENON JOINT — VIII

John E. Doren, Eureka High School, Eureka, California

(Continued from page 63A, March, 1937)

Until one is quite experienced in cutting tenons by hand, it is well to follow the procedure as outlined for cutting relished tenons by hand, cutting the haunch shoulder last. But, whatever the order of the steps in cutting a tenon, it is essential that one have a definite idea of what is to be accomplished, and endeavor to arrive at the result desired with a minimum expenditure of time and energy. It is suggested that the rip cuts be made first whenever this is practical. Figure 48 shows an orthographic drawing of the "relished-and-haunched" tenon.

Questions for Thought and Discussion

Consider the open frame illustrated in Figure 49:

1. What types of tenon may be used for joining the stiles and rails of this frame?
2. Which type of tenon joint would you recommend to use if the joints had to be made entirely with hand tools? Which type would you recommend if the points were to be made by machine? Why?
3. What thickness would you recommend for the tenons?
4. What width would you recommend for the tenons on the top rail?
5. What width would you recommend for the tenons on the middle rail?
6. In case the long blind tenon is specified for this frame, how long would you make the tenon?
7. Make an orthographic sketch (freehand) showing detail of the joint between the top rail and the stile. Place all necessary dimension lines and write in the dimensions
   a) for through tenon joint
   b) long blind tenon joint.
8. Make a detail drawing of the joint between the middle rail and the stile showing long blind tenon.
9. What advantage would there be in wedging the tenons if the frame were to be exposed to considerable dampness?
10. What advantage is there in relishing the tenons on the top and bottom rails? What would be gained by relishing the tenons on the middle rail?

To speed up production and conserve energy as well as time, a very accurate "cutting bill" is frequently made of the different members of mortise-and-tenon work. One who is familiar with this kind of work can work from a cutting bill more conveniently than from a large detail sheet. When all material involved is plain on the edges, the tenons are always placed in the center of the thickness, unless otherwise specified. In Figure 39, the stiles are shown extra long. When making up frames of this type, ½-in. "horns" should be left at the ends of the stiles in *every instance, but one must reckon with this extra length when laying out the mortises,* and it must be shown in the cutting bill. The horns, of course, will be trimmed off when the frames are fitted to the respective openings for which they are made.

Example of Cutting Bill

1 open frame — 1 in. × 2 ft. 6 in. × 5 ft. (Fig. 50)
Stiles — 2 pc. 1 in. × 2½ in. × 5 ft. 1 in., mortise to detail
1 pc. 1 in. × 2½ in. × 2 ft. 4 in., tenon 2 ends ⅜ in. × 2 in. × 1¾ in. relished
Mid rail — 1 pc. 1 in. × 1 in. × 2 ft. 4 in., tenon 2 ends ⅜ in. × 1 in. × 1¾ in. full width
Bot. rail — 1 pc. 1 in. × 3½ in. × 2 ft. 4 in., tenon 2 ends ⅜ in. × 3 in. × 1¾ in. relished

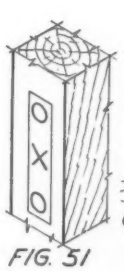


FIG. 51

FIG. 52

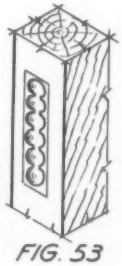


FIG. 53

Test

From the cutting bill, make an exact detail of the tenon on the (*a*) top rail, (*b*) middle rail, (*c*) bottom rail.

To Cut a Blind Mortise by Hand

The Boring-Out Method

1. (*a*) Lay out the mortise accurately (see Fig. 51). (*b*) Hold work securely and bore end holes of the mortise to the required depth. End holes should be located from 1/32 in. to 1/16 in. away from the end lines. Use an

auger bit fully 1/16 in. smaller in diameter than the width of the mortise, and use care to avoid cutting across the side lines.

2. *To Stop Boring with Auger Bit at Required Depth.* Count the revolutions of the bit from the time the lips begin to rout out the chips, as shown in Figure 52. If in doubt as to the cutting speed of a bit, bore 12 or 15 revolutions into a scrap block of similar wood and measure the depth the bit has gone. Augers should cut freely and must not be forced. The worm on the end should pull the bit into the wood without pressure being applied. When the number of revolutions and the distance the bit has bored are known, it is a simple matter to determine the number of revolutions necessary to bore a hole to a given depth. By this method, any number of holes may be bored in the same piece and all be within 1/32 in. of the same depth.

3. *Proceed now to bore out the remainder of the mortise* and let the holes run together; the holes should break into each other as shown in Figure 53. If possible, leave no partitions between holes to break out later with a chisel (see Fig. 54). These partitions are hard to break out and there is always the danger of breaking a chisel during the operation.

4. *To bore out a relatively large mortise* with comparatively small bits, always use the largest bit available and stagger the holes as shown in Figure 55. Bore the end holes first within 1/32 in. of the end lines, and let the other holes all break into each other. Chiseling is made easier if an extra hole of small diameter is bored at each end.

5. *Chiseling.* Use the widest chisel possible and cut down the side walls of the mortise after having first cleared out the auger-bit chips. Start chiseling near the center, and with a series of light cuts, work to the gauge marks. To break away the chips from the side walls of the mortise, twist the chisel as indicated by the arrow in Figure 46. This procedure will also clear the bottom of chips if the chisel is forced all the way down before twisting.

6. When the side walls have been fairly well cleaned, cut down the ends with a chisel that will enter the mortise without binding.

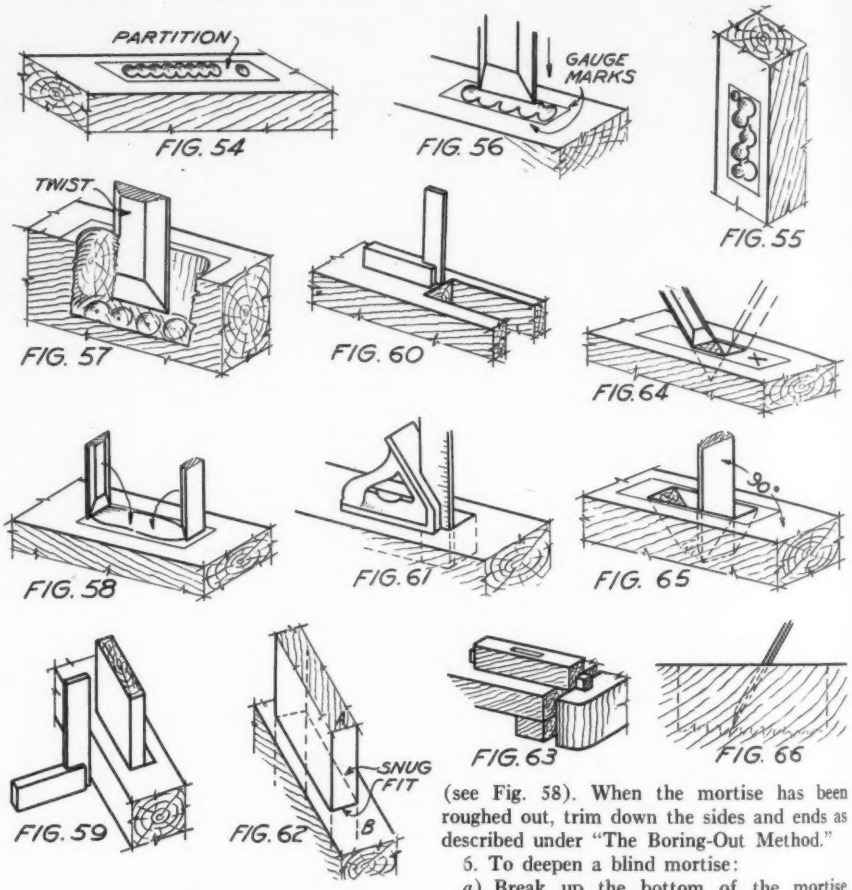
Approach the end lines with a series of light cuts. When the chisel is placed on the line for the last cut, there should not be more than 1/32 in. of material to remove.

If any prying seems necessary, pry chips into the mortise as indicated by arrows in Figure 58. All arrises around the mouth of the mortise must be sharp. Prying over them will bruise or crush them and spoil the appearance of the work.

The bottom may be cleared by scraping with a chisel. The work must then be turned over and the chips shaken out.

7. *Testing.* Test the mortise before closing the joint. Test the side walls with any straight object that will enter easily and compare the part that projects out of the mortise with a straight object held against the working face as shown in Figure 59. Test both walls. If bottom of mortise shows narrow, trim sides with wide chisel and test again. The ends may be tested in several ways: (*a*) One way often used is to set a try square on the work and sight into the mortise as shown in Figure 60. (*b*) A combination square, if available is the best tool for testing, as the ends and the depth can both be tested at one setting (see Fig. 61).

When the joint is closed, there should be no gaps anywhere between the sides of the tenon and the walls of the mortise. The mortised and tenoned members should stand in correct relation to each other as determined by the drawing being followed. The tenon should fit the mortise neatly and require but slight force to press it into place. A loose-fitting tenon is not at all satisfactory, and a tight tenon may split the mortise at the ends.



The Beating-Out Method

1. Lay off mortise as usual.

2. Hold stock securely with mouth of mortise up. The most satisfactory way to hold the work is between the bench pins as shown in Figure 52.

3. Select a chisel that is at least 1/16 in. narrower than the width of the mortise.

4. Start near the middle of the mortise and make a V cut as shown in Figure 64. Notice the position of the beveled side of the chisel with regard to the cut. By a series of light chips, continue the V cut until it has reached the required depth. The hammer may be used for driving the chisel when small mortises are to be cut (mortises up to ½ in. wide and 2 in. deep) regardless of whether the wood to be mortised is hard or soft. The side of the hammer head should strike the chisel rather than the hammer face.

5. Keep the face of the chisel as nearly square with the surface of the work as possible (see Fig. 65), and cut down into the mortise. Drive the chisel with the side of the hammer head and pry chips into the mortise (see Fig. 58). When the mortise has been roughed out, trim down the sides and ends as described under "The Boring-Out Method."

6. To deepen a blind mortise:

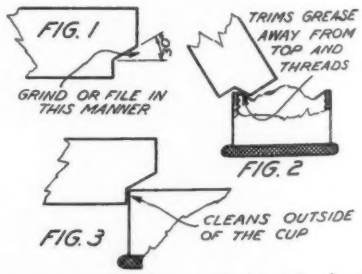
a) Break up the bottom of the mortise by cutting across the grain with a chisel as shown in Figure 66, after which the chips may be scraped out.

b) With a wide chisel, clean out the corners, and by twisting the chisel, clean out the bottom as shown in Figure 58.

OLD TABLE KNIFE MAKES HANDY GREASE-CUP FILLER

Frank Bentley, Jr., Clinton, Iowa

A small wood paddle is the usual device used for filling grease cups. A much handier filler can be made out of an old case or common table knife. Cut it off about in the center and grind or file the end of it as shown in



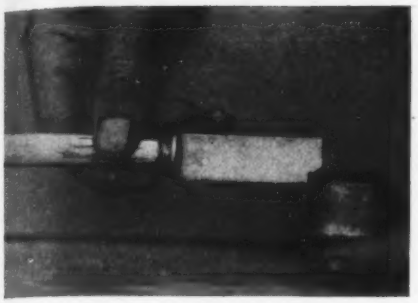


Figure 1. The portion at an angle is turned around on the inside of the top of the cap when filled, as shown in Figure 2, and neatly tapers the grease off and away from the threads. When the cap is applied to the stud and turned, grease will not squeeze out as it usually does with a cap filled squarely across. Particles of grease left on the outside of the cap may be removed readily by running the end of the blade around it, held at a right-angle position as shown in Figure 3. The thin blade is easily kept clean, and but little wiping or cleaning is necessary when cups are filled with this practical homemade device.

TREAT DISH

Joseph J. Lukowitz, Milwaukee, Wisconsin

On page 283 of the September, 1936, issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, a complete description of the construction of a candy dish made from the bottoms of two tin cans was given.

Fig. 1. Treat dish

The preliminary steps in the construction of the treat dish shown herewith are identical with those described for the candy dish.

For the treat dish shown in Figure 1, a 5-in. can bottom is required for the bowl and a 2⅝-in. can bottom for the base. Cut out the bottoms and beat them to shape as described in the article referred to in the foregoing. The 5-in. can bottom should be dished to a depth of about ⅝ in. The scallops in the rim are then formed as shown at A, Figure 2. After the scallops are beaten in the rim, the bowl will have a much greater depth than ⅝ in. The scallops or flutes are finished on the block shown at B, Figure 2. At C is shown how the block is used. The intermediate steps in finishing the flutes on the block are shown at D. When the flutes are finished, beat the bowl to the finished depth of 1¼ in. as shown at E.

The base is shaped just as the base of the candy dish described in the September, 1936, issue of this magazine. The beads in the base are formed as shown at F. These beads should not be raised more than 1/16 in. Strike the nail lightly, otherwise the tin may be cut through. Be sure to hold the can bottom flat against the end grain of a block of wood as shown at F, when forming the beads.

The small tube connecting the bowl and base is made from a piece of ⅝ by 2⅜-in. tin cut from the side of the can. A simple foolproof method of making this tube is

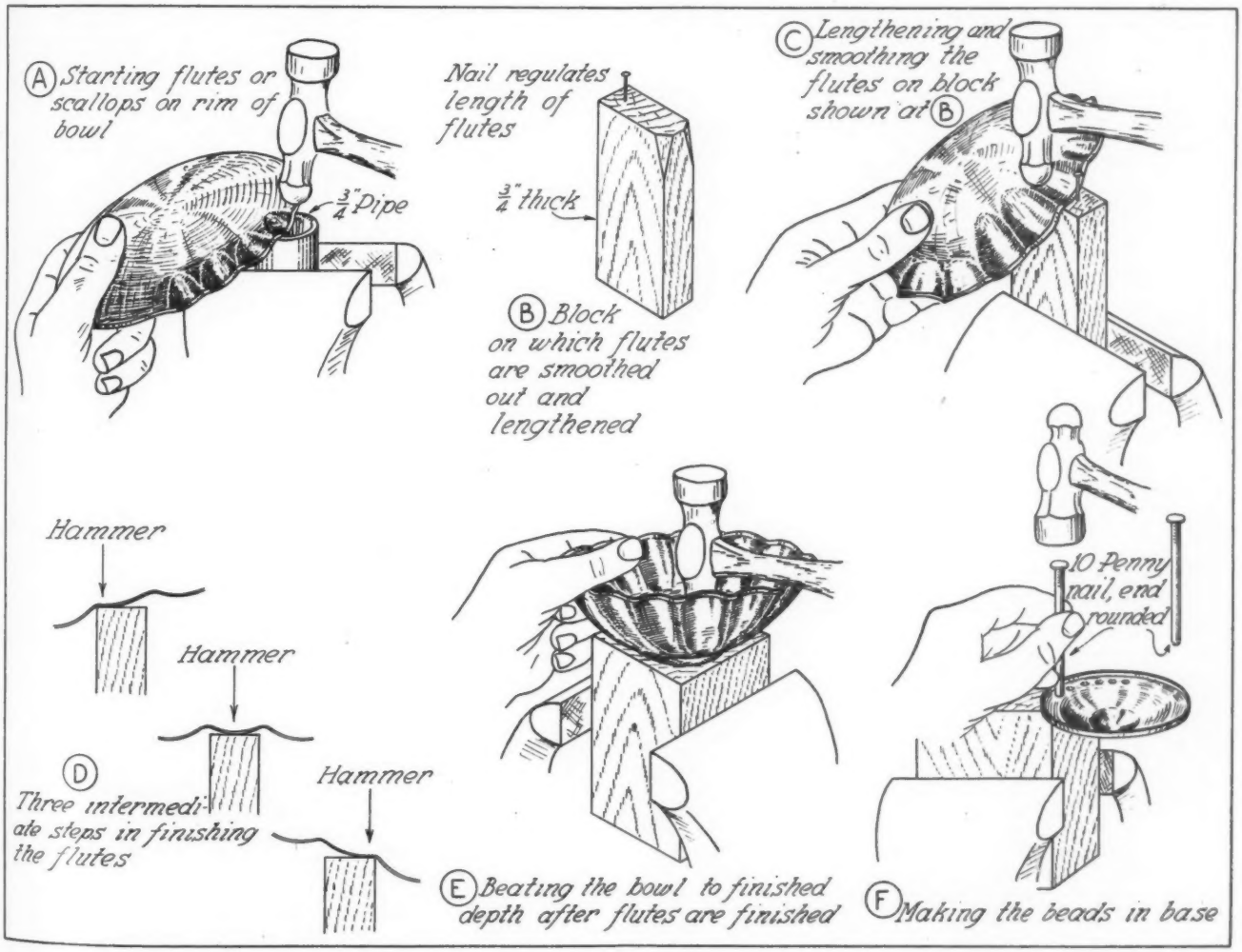

A Starting flutes or scallops on rim of bowl
¾" Pipe
Nail regulates length of flutes
¾" thick
B Block on which flutes are smoothed out and lengthened
C Lengthening and smoothing the flutes on block shown at B
Hammer
Hammer
Hammer
D Three intermediate steps in finishing the flutes
10 Penny nail, end rounded
E Beating the bowl to finished depth after flutes are finished
F Making the beads in base

Fig. 2. Step-by-step method of beating out the bowl

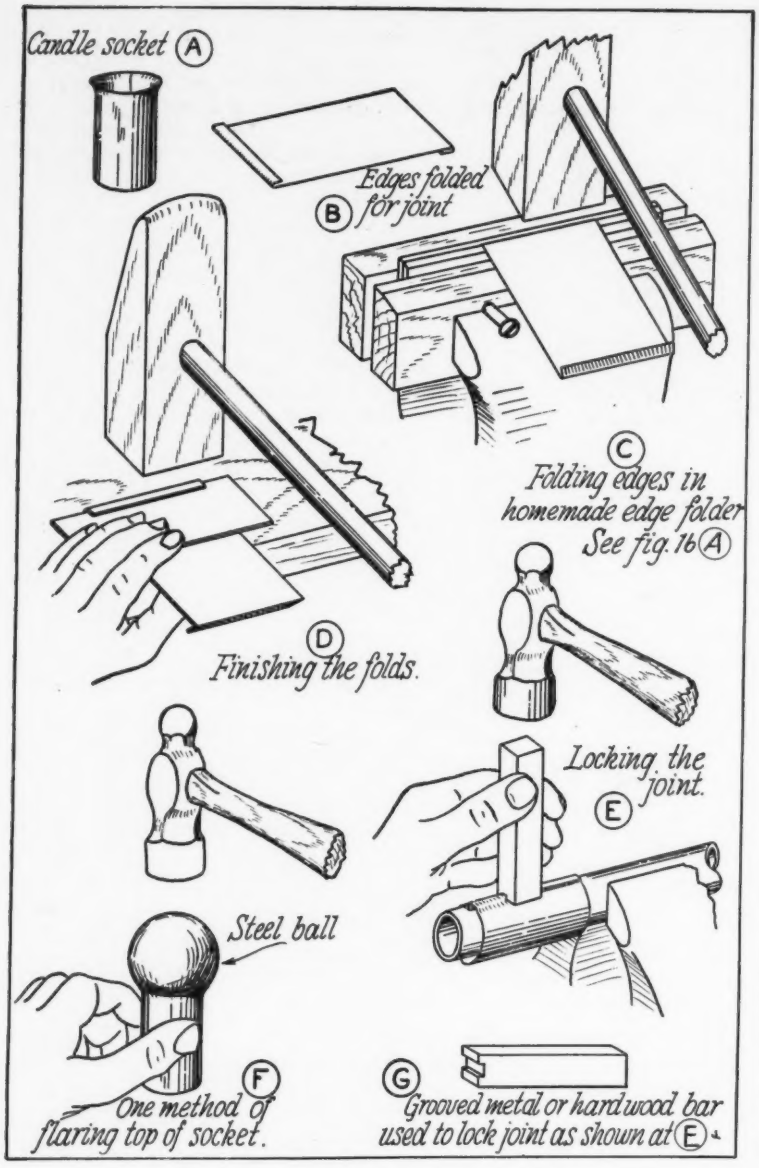
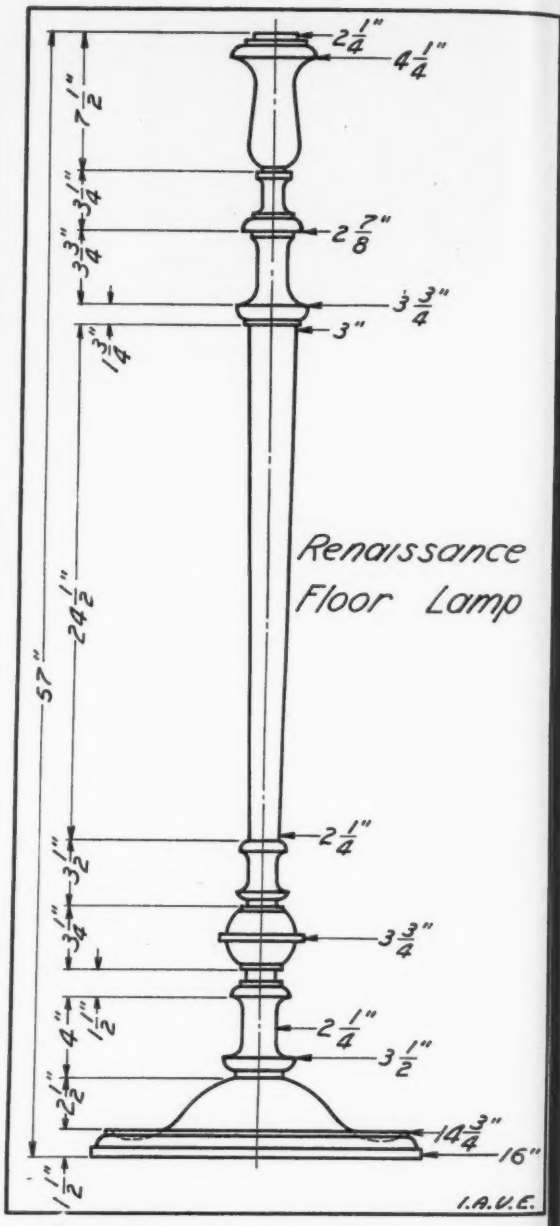


Fig. 3. Making a candle socket or tin tube



Italian Renaissance Floor Lamp designed by Reinhold Forkel, School of Industrial Arts, Trenton, New Jersey

illustrated by Figure 3. Of course, the ends of this particular tube are not flared. A short piece of copper tubing could be used instead of making a tin tube. If this is done, the copper tube should be tinned.

The bowl, tube, and base may be held together with a large rubber band while being soldered. A rubber band cut from an old inner tube will answer nicely.

The tubing could be omitted and the base soldered directly to the bowl by punching a hole through the center of the base and then soldering the two parts together as shown at H, in Figure 2, page 283, September, 1936, issue. There are a great number of possible variations which may be embodied in this type of work, and boys will soon be found to exercise more originality and resourcefulness with it than they do when working in other mediums.

Those interested in the broad possibilities of this work are referred to *55 New Tin-Can Projects* (The Bruce Publishing Co., Milwaukee, Wis.).

Association News

MASSACHUSETTS SOCIETY HOLDS MEETING IN BOSTON

The Massachusetts Industrial-Education Society held its annual meeting on January 16, in Boston. Approximately 150 teachers were in attendance.

Following the dinner and welcome from President Van Ham, an excellent program was carried out under the direction of Mr. A. Ventura, chairman of the social committee. Judge Joseph T. Zottoli, associate justice of the municipal court, talked on "Juvenile Delinquency," drawing on his wealth of experience, and tracing the causes which lead to delinquency. He urged that all young delinquents be provided with worth-while training in the institution that will bear fruit in later years. He pointed out that teachers are the front-line soldiers in the battle against ignorance and greed and he stressed a larger development in the teaching of the arts and crafts.—*A. Irving Dodge.*

WESTERN ILLINOIS INDUSTRIAL-ARTS ROUND TABLE

The December meeting of the Western Illinois Industrial-Arts Round Table was held on December 9, at the Elks Club, in Galesburg. A total of thirty-one members were in attendance.

The meeting was opened by the president, Mr. Nelson, who gave a short talk on "Work." Mr. Lester, principal of the Lombard Junior High School, in Galesburg, gave a talk on "The Admin-

(Continued on page 10A)

NOW---
A "BOY-SAFE" JOINTER
By WALKER-TURNER

6" JOINTER WITH DUAL PURPOSE GUARD

Walker-Turner engineering pioneers again! Bringing you the "Dual-Purpose" Guard on the new 900 Series Jointer—a feature that makes the Jointer, for the first time, a completely safe tool for school shops!

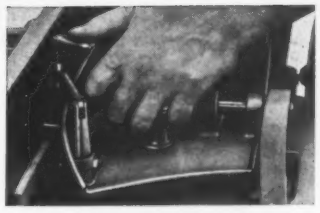
GREATER SAFETY...MORE USES...

In addition to protecting the user's hands in any operation, the Dual-Purpose Guard further extends the usefulness of the Jointer, making possible the planing of wide, thin boards or thin strips to ribbon thickness with complete safety.

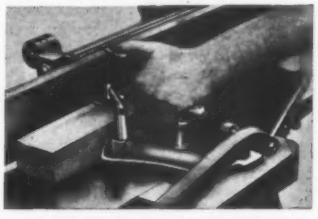
HOW IT WORKS...

The guard itself may be used either to hold work down against the blade or to hold it against the fence. In either case, the user's hands are protected. Illustration shows the guard holding the work against the fence, with the thumb pressure guide supplying the necessary down pressure. Lower illustration shows the guard holding a wide piece of stock down against the blade as it is planed ribbon-thin, safely.

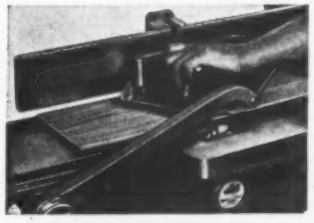
Equipped with a ½ H.P. split phase motor, which turns the cutter at 12,000 cuts per minute, the Walker-Turner Series 900 Jointer does smooth, level work on every job. See it at your dealer's, or write for details.



PLANING THIN STRIPS



HOLDING WORK AGAINST FENCE



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SCHOOL

is a new text for courses in methods of art-teaching. Its thirteen units cover industrial and commercial art as well as pure and applied design. In addition to specific techniques, it emphasizes the relation of art education to the whole school program, and gives the teacher-in-training a basis for selecting pupil experiences that will prove significant to other phases of education.

To be published in May. $3.25 probable.

By
F. W. Nicholas, *Carnegie Institute*
N. C. Mawhood, *Supervisor of Art, Richmond, Ind.*
M. B. Trilling, *Carnegie Institute of Technology.*

Published by
THE MACMILLAN CO. New York

(Continued from page 142)

istrator's View of the Shop," in which he pointed out that the future of industrial arts depends upon the attitude of the instructors. Mr. Mulvey, the next speaker, talking on the subject, "The Relation of Industrial Arts to Vocational Education," stressed the value of vocational education and pointed out how important it is for those who do not go on to college. Mr. Mulvey gave a brief report on the A.V.A. meeting, in which he called attention to the Future Craftsmen of America Club.

It was voted to hold the next meeting on March 9, in Kewanee. — *Paul V. Morris.*

CENTRAL CONNECTICUT TEACHERS MEET IN HARTFORD

The Central Connecticut Industrial-Arts Association held its annual meeting on January 13, in Hartford. About forty members were present to enjoy the dinner and the talks.

Mr. H. C. Wiley, chairman of the program committee, introduced Col. Michael A. Conner, commissioner of motor vehicles of the State of Connecticut, who explained the work of his department and what is expected of the schools to insure better automobile drivers. He urged that safety in automobile driving be taught in the high school so that students of high-school age may be guarded against careless habits or the failure to recognize the consequences of carelessness. Mr. John W. Colton, of the *Hartford Times,* spoke of defects that may cause accidents in automobile driving. He stressed that industrial-arts teachers are the best qualified to teach safety in the schools.

The following officers were elected for the ensuing year: President, James H. Ginns, New Britain; first vice-president, Samuel B. Bassett, Waterbury; second vice-president, Frank J. Preston, Hartford; secretary, Harry A. Barnicle, Hartford; treasurer, Robert Ardini, Newington. — *Harry A. Barnicle.*

THE VOCATIONAL GUIDANCE MEETING IN DETROIT

The educational committee held its vocational guidance meeting for engineering and science students in Detroit, Mich., on December 11, with more than six hundred students and their parents in attendance.

The meeting was opened by Dr. W. E. Wickenden, president of the Case School of Applied Science, who gave a talk on "College and Careers," in which he outlined the essential qualities to be attained by a successful engineer. Dr. Wickenden impressed his hearers with the fact that choosing a career is a critical matter and that the selection of a lifework must be considered with the same seriousness as the choosing of any of the learned professions.

Mr. S. M. Deen, of the Detroit Edison Company, was chairman of the meeting. Actual counseling was given to students by fifty outstanding engineers, selected by local sections of national engineering societies. Inspection trips for the students were carried out with the aid of divisions of industries in which the students were interested.

Meetings of the same kind were held in many of the large industrial cities and were sponsored by the Engineers' Council for Professional Development. — *W. Nylund.*

WASHINGTON INDUSTRIAL-EDUCATION ASSOCIATION MEETS

The Washington Industrial-Education Association held its annual election of officers at the regular fall regional district meetings. The following officers were elected:

President, Mr. E. P. Fait, Everett; vice-president, Mr. C. A. Steelsmith, Walla Walla; secretary-treasurer, Mr. A. H. Drews, Everett.

The Association announces that the regular spring meetings will be held at Mount Vernon, Washington, and at Spokane, Washington. The dates will be announced later.

HOLD ROUND-TABLE MEETING

The industrial-arts round table number two held its March meeting on March 2, in the vocational building of the St. Charles School for Boys, in St. Charles, Ill. Mr. Carl C. Cramer, president of the association, presided.

Following a supper in the school dining room, a period of entertainment was furnished by the academic department. An inspection of the cottages, shops, and the culinary departments followed.

The business meeting was held at 8 o'clock in the vocational building, when short talks were given on the subject of vocational education. Departmental meetings followed the general session. — *R. A. Cooney.*

DRAWING CONFERENCE TO BE HELD AT AMES

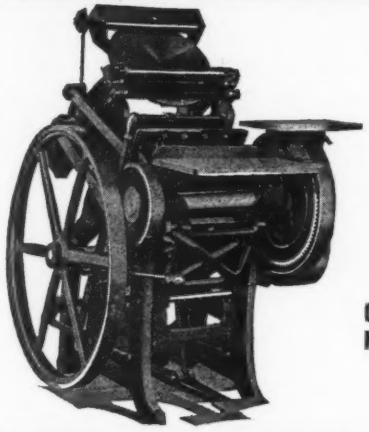
Teachers of industrial arts will be interested in a drawing conference, to be held April 23 and 24, in the Iowa State College of Agriculture and Mechanic Arts, in Ames, Iowa. Drafting teachers in Iowa and nearby states will be in attendance.

SOUTHEASTERN ARTS ASSOCIATION CONVENTION

The Southeastern Arts Association will hold its annual convention April 8 to 10, in the Hotel Sir Walter, in Raleigh, N. C. The theme of the

(Continued on page 12A)

. . . A Modern and Efficient Press, Ideal for School Use



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The C&P New Series Press is available in four sizes; 8x12, 10x15, 12x18 and 14½x22 with or without Automatic Feeder Units. Vibrating Brayer Fountains and other time- and labor-saving attachments may be added to these C&P Presses at a reasonable cost as shop needs require. Write for full information and prices on these presses and other C&P equipment.

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The BW Printer is especially designed to uniformly expose BW Paper. After exposure in the BW Printer, the print is developed instantaneously, in any regular BW Developing Machine, without washing or drying. No cumbersome blue print tanks or leaky plumbing! Using this BW Printer with average tracings on cloth or paper, an operator can easily print and develop two to three 50-yard rolls per day.

WHAT IT COSTS
The Model No. 3 BW Printer sells for only $295.00 for 110 A. C. ($15.00 extra for 110 D.C.). The BW Developing Unit No. 149 leases for $57.50 for ninety-nine years.

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THE STOUT INSTITUTE

SUMMER SESSION — June 21 to July 30, 1937

Undergraduate and Graduate Courses

The summer session at The Stout Institute is planned particularly for teachers and others interested in Industrial Education and Home Economics. In addition to work in these fields, an excellent range of courses is also offered in science, social science, English, education, and vocational education.

Carefully selected short units are available in a variety of combinations in such fields as Adult Education, Administration of Vocational Education, Supervision, Curriculum Construction, Parent Education, Vocational Rehabilitation and Rural Part-Time Education, taught by national leaders. These are supplemented by a series of unusually strong conferences in such fields as Distributive Occupations, Apprenticeship, and Rural Homemaking

Menomonie, located in Northwestern Wisconsin, is within short driving distance of the famous Wisconsin summer resort country. Residence facilities include expanded and remodeled dormitory accommodations, college camp colony, and numerous lake cottages. There are excellent opportunities for combining professional study and recreational activities.

The Stout Institute summer session offers graduate curricula leading to the Master of Science Degree in Industrial Education or Home Economics, and undergraduate curricula leading to the Bachelor of Science Degree in these fields.

Write for the Summer Session Bulletin

Director of Summer Session

The Stout Institute **Menomonie, Wisconsin**

(Continued from page 10A)

convention will be "Art in Democratic Living." Information concerning the meeting or the speakers may be obtained from Miss May Kluttz, secretary, Hoke Smith Junior High School, Atlanta, Ga.

WESTERN ARTS ASSOCIATION WILL MEET IN TOLEDO, OHIO

The publicity committee of the Western Arts Association has announced the tentative program for the annual meeting of the Association, to be held April 14 to 17, in Toledo, Ohio. "Living in the Arts" has been selected as the subject for the meeting.

The Toledo Museum of Art will be available during the convention, and the beautiful peristyle will be open for the benefit of the visitors. A conducted tour will be made to the cloisters, the galleries, the classrooms, and lecture halls. A current exhibit of German water colors will be an added attraction at that time. Tours will also be made to the DeVilbiss plant, to the Willys-Overland Corporation, and to the Queen of the Holy Rosary Cathedral, an example of the classical type of Spanish architecture.

There will be an exhibit, noteworthy among the displays of which will be the Cizek exhibit and the Wisconsin Project. The exhibit offers new ideas to workers in the handicrafts and will display home crafts of original design by unskilled women workers under the direction of trained supervisors.

A visit will be made to the Libbey-Owens-Ford and the Libbey Glass plants where glass containers and accessories will be explained and their use demonstrated.

South Central Minnesota Teachers Meet

The South Central Minnesota Industrial-Arts Teachers held their regular midwinter meeting on January 16, at the State School for the Deaf in Faribault.

Following a get-together period from 1:00 to 10:45 a.m., a short business session was held. A number of interesting demonstrations in wood carving were given by Mr. Ersche, of the St. Paul Vocational School.

A dinner was served at the school to 40 teachers, principals, and superintendents. Dr. Homer J. Smith, of the University of Minnesota, who was the main speaker, talked on the subject, "Which Way Shall We Go in Industrial Education?" He was followed by Mr. H. W. Teichroew, co-ordinator of the St. Paul Vocational School, who spoke on "The Placement of Trainees." Mr. Widdowson, state supervisor of industrial arts, conducted the discussion period.

The remainder of the program was given over to a demonstration in welding and metal cutting with acetylene torch, conducted by a representative of the Linde Air Products Company. — *Fred S. Cook.*

Western Pennsylvania Industrial-Arts Conference

The Western Pennsylvania Industrial-Arts Conference will be held on April 17, at the State Teachers' College, California, Pa. The meeting will attract approximately 600 educators from Pennsylvania, Ohio, Virginia, West Virginia, and Maryland. There will be both a morning and a luncheon session.

Plans have been made for an exhibit of industrial-arts projects and a commercial exhibit of tools and materials for industrial-arts work. — *S. L. Coover.*

MODEL YACHT COMMITTEE

The model yacht committee of Detroit, Mich., is a group which sponsors projects in model boat building as an industrial-arts activity. Regularly each year it has charge of the Model Yacht Regatta which culminates the year's activities in the public schools. At its recent annual business meeting, Ernest Gardner was elected chairman for one year, and Norvan Jennerjahn was named secretary-treasurer.

Personal News

IS APPOINTED DEPUTY SUPERINTENDENT

Dr. Gerald D. Whitney, formerly professor of education in the University of Pittsburgh, has recently become Deputy Superintendent of Public Instruction, Commonwealth of Pennsylvania, Harrisburg, Pa. He succeeds Dr. Samuel Fausold.

Dr. Whitney was born in Bradley, Mich., where he received his common-school education. His secondary education was obtained in the public schools of Kalamazoo, Mich. His higher and professional education was pursued in several institutions, including Western State Normal School, Kalamazoo, Mich., Carnegie Institute of Technology, Columbia University, and the University of California.

In 1936, after completing extensive studies in the field of education, Dr. Whitney received the M.A. degree from Columbia University. He also holds a Sc.D. degree, given by Stout Institute, Menomonie, Wis.

The professional experience of Dr. Whitney has been varied, and extends over a period of twenty years. From 1905 to 1908, he taught in the rural schools of Kalamazoo County, Michigan, and from 1909 to 1919, in the Pittsburgh

(Continued on page 15A)

KANSAS STATE TEACHERS COLLEGE

1937 Summer Session
MAY 31 — JULY 30

Department of Industrial and Vocational Education

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For summer session bulletin address

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Summer Session—June 21 to July 30, Post Session—August 2 to August 27

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The student may plan a program which will lead through successive summers to the bachelor's or master's degree. Approved programs carrying the recommendation of Oregon State College are accepted by all state departments of education for either a *Special* or a *General Secondary* Credential. See the half-page advertisement in the March issue of Industrial Arts and Vocational Education for a full list of courses available in the Industrial Education program.

Authorized by State Board of Higher Education

Address: **Department of Industrial Education**
Oregon State College
Corvallis, Oregon

(Continued from page 12A)

elementary, junior, and senior secondary schools. He served as director of vocational education in Altoona, and later became supervisor of industrial education in the department of public instruction, where he served for four years. In 1924, Dr. Whitney was called to the University of Pittsburgh to assume the position of director of the vocational education program, a position

DR. GERALD D. WHITNEY

which he continued to fill until his present appointment as deputy state superintendent of schools.

¶ Mr. J. V. Lynn, formerly professor of vocational education in the Iowa State College at Ames, died on December 26, at his home in Woodstock, Ontario, Canada. Mr. Lynn received the degree of B.S. from Stout Institute in 1920, and the M.S. degree from Pennsylvania State College in 1930. He was known and respected by many teachers and supervisors of industrial education.

¶ Mr. Stanley G. Fitzgerald, assistant director of vocational education in Albany, N. Y., died recently in St. Peter's Hospital, Albany. He was 40 years old. Mr. Fitzgerald was a native of Albany and attended the Albany high school and the State College for Teachers. After serving for a time as coach at St. Joseph's Academy, Mr. Fitzgerald went to Indianapolis, where he assumed his first teaching position in the manual-training department of the high school. From there he went to Racine, Wis. After completing his army service, Mr. Fitzgerald returned to Albany in 1922, to act as supervisor of industrial arts.

¶ Mr. Steven Prensner is instructor in the laboratory of industries in Liverpool, Tex.

¶ Mr. C. W. Anderson is instructor in the laboratory of industries at La Vaga High School, near Waco, Tex.

¶ Mr. Merritt W. Haynes, of Huntington, N. Y., has been appointed as instructor in the evening teacher-training classes in New York City.

¶ Mr. R. R. Kyl, of West Point, Nebr., has been engaged as industrial-arts teacher in the high school at Harlan, Iowa.

¶ Mr. Floyd I. McMurray, state superintendent of instruction of Indiana, will shortly take over the supervision of the state's vocational-education activities. The change is being made under a new state setup which seeks to coordinate vocational education with the new law effective July 1, 1937.

Propose State-Aided Vocational Courses

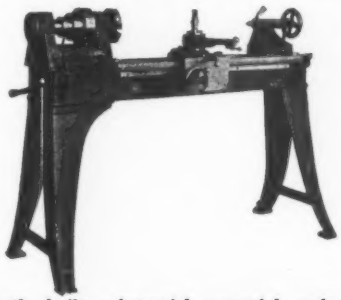
A citizens' group in Dalton, Mass., has voted to ask the school board to establish and maintain a state-aided vocational agricultural department in the high school.

School-Shop Equipment News

NEW OLIVER 12-IN. SPEED LATHE

The Oliver Machinery Co., Grand Rapids, Mich., has announced its new 12-in. speed lathe, especially featuring the new ball-bearing motor-in-head "V" belt drive. It is designed to meet the demand for finishing, accuracy, and general utility in the metalworking shop.

The new Oliver speed lathe is well designed,



correctly built, substantial, powerful, and easily operated. All parts are jig machined and fitted to templates, and the materials used are the best obtainable.

The lathe is fitted with a belt-driven headstock 12¼ in. long, and 10½ in. wide. The bearings are fitted with adjustable split-bronze ring-oiled bushings. The oil wells are amply large and have both level and drain plugs. The spindle runs in Parsons white bronze, ring-oiled bearings

(Continued on page 17A)

THE MARKET PLACE

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Off-Set Spring Cutting-Off Tools

Makes cutting-off, the most difficult lathe operation, easy. Goose-neck form prevents work from climbing upon tool — the cause of most tool breakage.

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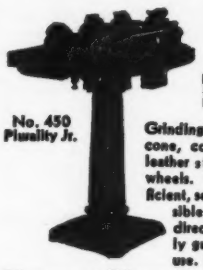
TOOLS ALWAYS SHARP with PLURALITY OILSTONE TOOL GRINDERS

Now available in 3 sizes
No. 425 Plurality Sub Jr.
No. 450 Plurality Jr.
No. 475 Plurality



No. 450 Plurality Jr.

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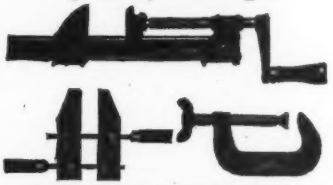

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INDUSTRIAL ARTS and VOCATIONAL EDUCATION

May. 1937
Vol. 26, No. 5

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CONTENTS

Graduate Work on the Doctoral Level, *by R. W. Burgett*..... 143
Minnesota's Contribution to Guidance, *by William W. Wills*..... 145
Present Trends in Vocational Education, *by James Hoskins*..... 147
Editorial 149
Co-operative Vocational Training, *by L. Clifford Herness*..... 150
The Boy, the Project, and the Teacher, *by Edward H. Crussell*..... 151
Glossary of Printers' Terms — II, *by R. Randolph Karch*..... 153

Supplements

Buffet Lamp, *by Clifford B. Smith*.....No. 338
Try This One, *by Charles Quinlan*.....No. 339

Testing and Tests

A Comment on Tests, *by Richard M. Bell*..... 155
Mechanical-Drawing Test, *by R. N. Donelson*..... 158
Printing Tests, *by Frank Di Giacomo*..... 160
Safe-Driving Test, *by O. P. Schneider*..... 162

Problems and Projects

Candle Ornament, *by Colin D. Robertson*..... 163
A Metal Picture Frame, *by S. H. Puehler*..... 163
Cedar Chest, *by G. Harold Billingham*..... 164
Canoe Paddle, *by Frank Cerveny*..... 165
10-Foot Kayak, *by James McGregor*..... 165
Tool Cabinet for Sheet Metal, *by G. B. Westerberg*..... 168
Removing Warp from Boards, *by F. E. Tustison*..... 168
Hollow Log Bird Houses, *by W. Ben. Hunt*..... 169
Indian Wigwam, *by W. Ben. Hunt*..... 170
Lincoln-Head Shield, *by C. H. Niemann*..... 172
A Timekeeper's and Scorer's Table, *by R. L. Ready*..... 172
Personal News..... 172
School-Shop Equipment News..... 17A
Association News..... 10A

REQUISITIONS

The May issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION is entitled the "Requisition Number" because the month of May is admirably suited for making a study of what the school shop will require in the way of tools, equipment, and supplies for the coming school year.

During this month teachers and supervisors are not as yet harried by the hustle and bustle of examination time, closing exercises, and the like. The problems of the school shop can still be viewed with calmness in May. Frequently these problems foreshadow future needs for repairs, replacements, additions, or for new tools, equipment, or supplies.

There is time also to discuss new courses that are to be added, alterations to be made in the shop, or changes in the location of the equipment already at hand.

It is true, the orders may not be placed until later, but May is the time when those who are best able to say what is needed — the instructors who are intimately acquainted with the needs of their shops — are still in attendance. It is they who can give first-hand information what the future requirements are. It is they who ought to write the requisitions for the items that are to be provided for the coming school year.

SUMMER SCHOOL

May also is the month when shop teachers plan for their summer vacations. It speaks well for the profession that so many of them choose to attend summer schools in order to improve themselves for the important task of teaching the youth of America.

In order to make easier the task of choosing a suitable summer school, attention is here called to the following institutions that have prepared statements of offerings which may be found in the advertising sections of the April and May issues of this magazine.

Bradley Polytechnic Institute, Peoria, Ill.
Kansas State Teachers College, Pittsburg, Kans.
Oregon State College, Corvallis, Oreg.
Pennsylvania State College, State College, Pa.
The Stout Institute, Menomonie, Wis.
University of Minnesota, Minneapolis, Minn.
Wayne University, Detroit, Mich.

Articles Indexed — The articles contained in the Magazine are regularly indexed in "The Reader's Guide to Periodical Literature," and "Education Index."
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Editorial Contributions — The Editor invites contributions bearing upon Industrial Arts, Vocational Education, and related subjects. Manuscripts, drawings, projects, news, etc., should be sent to the Publication Office in Milwaukee. Contributions are paid for at regular space rates. In all cases manuscripts should be accompanied by full return postage.
The Magazine is on sale at Brentano's, New York; Wanamaker's, Philadelphia; Brentano's, Chicago; Philippine Education Co., Manila, P. I.

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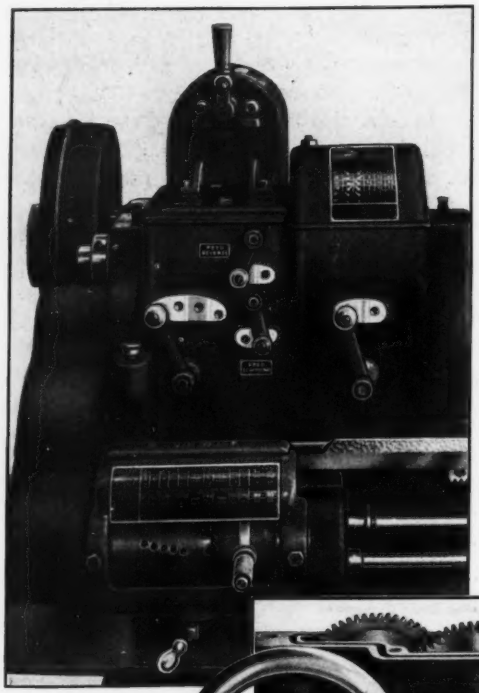

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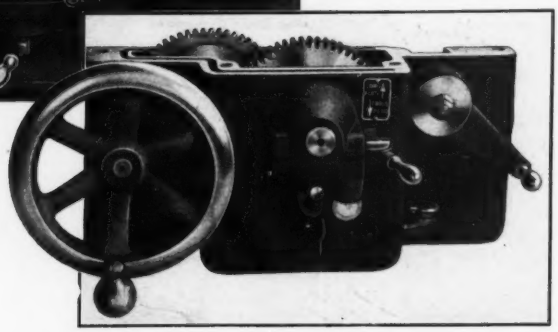

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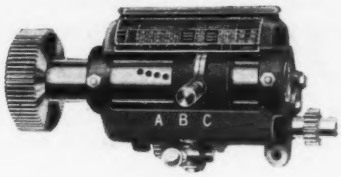

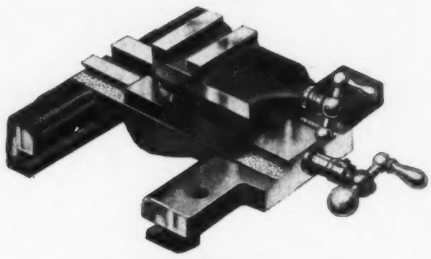

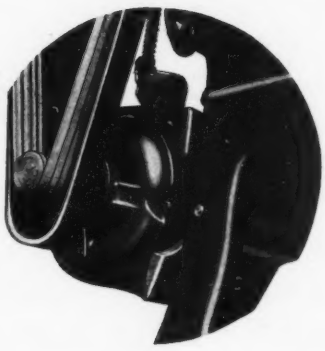

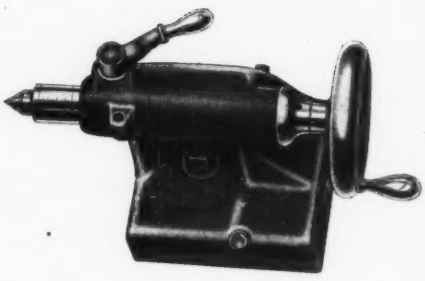

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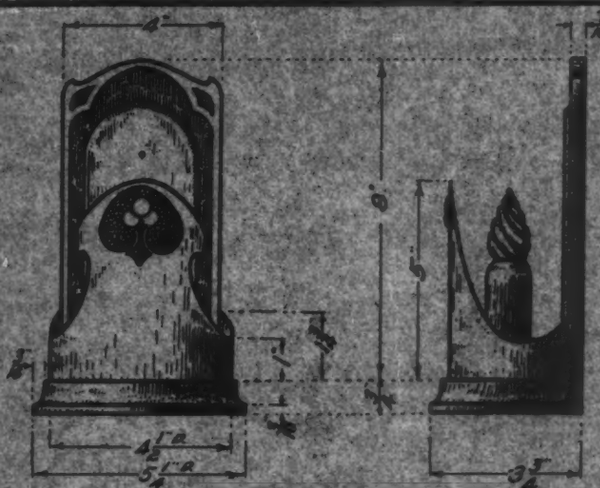
BUFFET LAMP

Advanced Woodwork

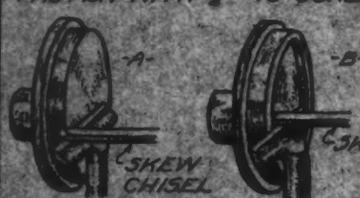
PROJECT SHEET A-200



Scale 1/4"=1"

FIRST KNOW EXACTLY WHAT TO DO, THEN DO IT!

BASE — CUT BASE A LITTLE OVERSIZE. PLANE A FACE SIDE. DRAW THE DIAGONALS ON THIS SIDE. WITH THE INTERSECTION AS A CENTER DESCRIBE A 5¼ CIRCLE. BANDSAW.— PLACE FACE PLATE ON FACE SIDE, CENTER CAREFULLY AND FASTEN WITH ¾"-#10 SCREWS.— W-1, W-99.



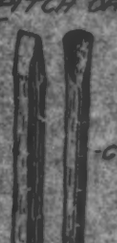
ROUGH DOWN TO DIAMETER 5¼, USING A SKEW CHISEL. DRESS TO ¾ IN THICKNESS. SEE -A- WITH SKEW HOLLOW OUT FACE ⅛ DEEP AND TO A DIAMETER OF 4½. TURN THE EDGE AS SHOWN AT -C- USING A ROUND-NOSE TOOL. SAND.—

BACK — CUT FROM ¼ STOCK. OBTAIN THE FACE SIDE, FACE EDGE, FIRST END, WIDTH AND THICKNESS. LAYOUT THE CURVE FOR THE TOP AS SHOWN AT -D-. BANDSAW. W-1, W-99.— CLAMP BACK TO THE BENCH, AS AT -E-, WITH A HANDSCREW. CUT TO THE LINE WITH A CHISEL AND A ¼ GOUGE. W-20.—

EITHER PEEN IN THE DESIGN OR RECESS THE BACKGROUND WITH A ROUTER-PLANE AND CARVING TOOL. SAND.— MEASURE 3½ FROM THE OUTSIDE EDGE OF THE BASE. DRAW A STRAIGHT LINE AND BANDSAW. FASTEN BACK TO BOTTOM WITH 1½-#6 F.H. SCREWS. W-8.— SPONGE WOOD. RE-SAND. STAIN AND SAND TO TWO TONES. APPLY A SHELLAC FINISH.— F-5. F-1.

SHADE AND REFLECTOR — THE SHADE AND REFLECTOR MAY BE MADE FROM #22 GAUGE COPPER OR BRITANNIA METAL. LAYOUT YOUR PATTERN FROM -F-. W-6. WITH ⅛ HOLLOW PUNCH OBTAIN CURVE AT -X- THIS IS PUNCHED OUT ON END GRAIN OF A PIECE OF HARD WOOD. WITH STRAIGHT SNIPS CUT THE SHADE EXACTLY TO ITS OUTLINE. THE CURVED SNIPS MAY BE NECESSARY AROUND THE LUGS. FILE EDGES SMOOTH AND STRIKE-OFF BURR. WITH THE SLIP-ROLL FORMER, BRAKE THE METAL BY RUNNING IT THRU SEVERAL TIMES, REVERSING IT EACH TIME. NOW FORM IT TO SHAPE.— ST-7.

CHASE IN DESIGN, WORKING ON PITCH OR A CURVED BLOCK OF WOOD. AT -G- ARE SHOWN TRACERS THAT MAY BE USED FOR THIS PURPOSE. USE A BACKGROUND TOOL FOR THE REST. BURNISH WITH STEEL WOOL. IF COPPER IS USED, HEAT IT SLIGHTLY UNTIL WAX WILL JUST MELT ON IT. WHEN DRY, POLISH.—



MAKE THE REFLECTOR 2½ BY 6½. WITH DIVIDERS LAY OUT SEMI-CIRCULAR TOP.— TRACERS DRILL THREE HOLES FOR THE COPPER NAILS. ASSEMBLE WORK. AT -H- IS THE METHOD OF WIRING. FIT NIPPLE SECURELY.—

Submitted by Clifford B. Smith, East Amherst, New York

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Tracing Supplement No. 338, May, 1937
INDUSTRIAL ARTS AND VOCATIONAL EDUCATION

FIGURES 5/8, 7/16, 5/16, AND ⅜ MAY BE ASSIGNED TO

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BUFFET LAMP

Advanced Woodwork

PROJECT SHEET A-200.

Scale $\frac{1}{2}$ = 1".

TO DO, THEN DO IT!

HER VEIN IN THE DESIGN OR RECESS
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ASURE 3¾" FROM THE OUTSIDE EDGE
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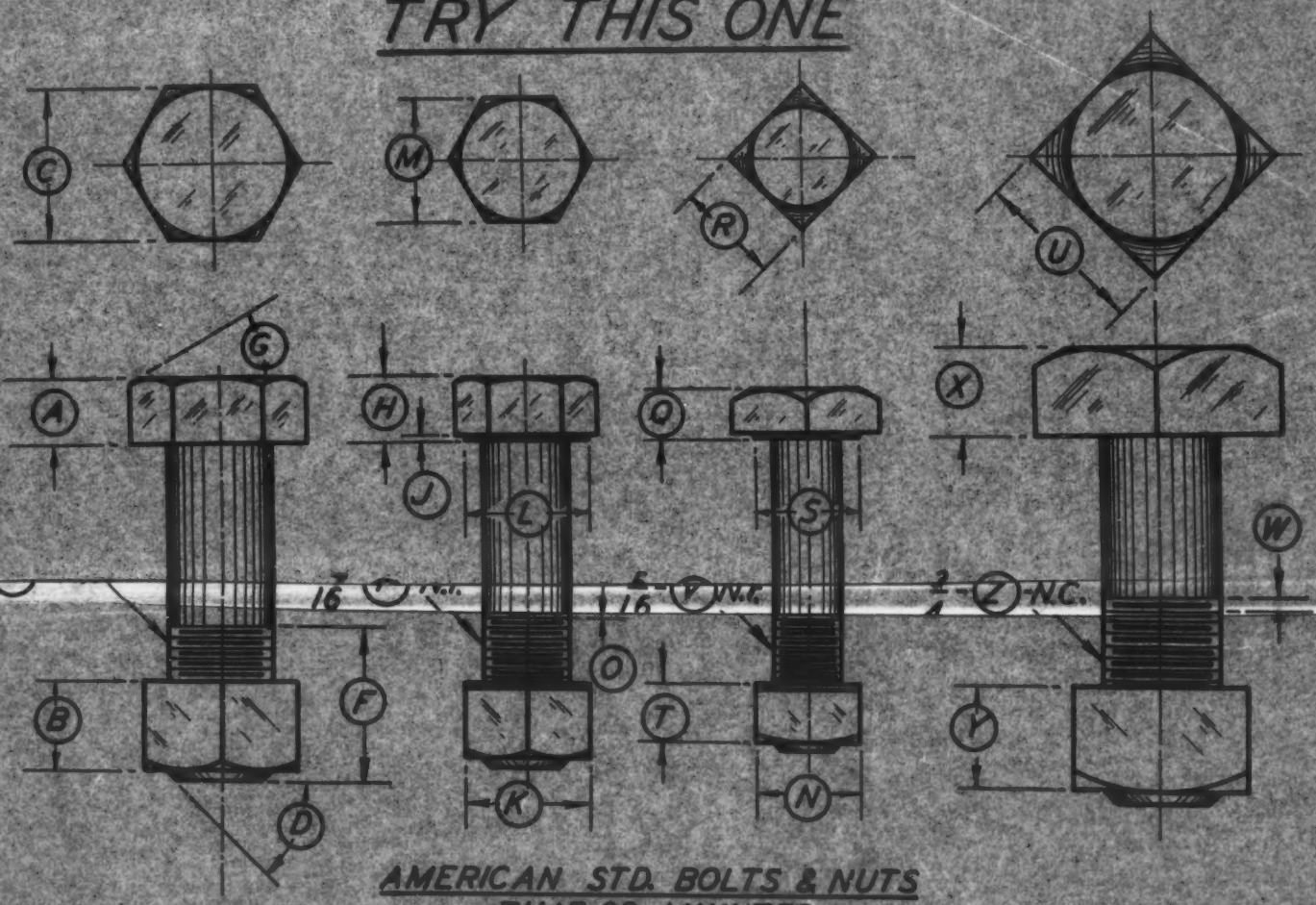

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TO MAKE THE TEST MORE USEFUL, BLOCK OUT FIGURES 5/8, 7/16, 5/16, AND 1/4 ON THE TRACING SO THAT INDIVIDUAL SIZES MAY BE ASSIGNED TO THE STUDENTS.

UNIV. OF MICH.

Submitted by Charles Quinlan, Jr., High School, Stratford, Connecticut